# ANNALS

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A Monographic Survey of South African Non-marine Mollusca.

By M. Connolly.

(With Plates I-XIX and 58 Text-figures.)

#### Introduction.

The title of this work signifies that it is not actually a Monograph in the usually understood sense—that is, it avoids setting forth at length bald descriptions of every species, frequently mere copies of the original or other authors', with entire absence of comparative notes on their relationship to allied forms, while it is not possible, on account of expense, to present adequate figures of all the species treated. In many genera several species are so nearly akin that it has appeared preferable to divide them into groups, limiting verbiage to description of their salient features and comparison with their nearest relations, with figure of at least one typical member of the group.

Thanks to the extreme courtesy of officials concerned, to whom he expresses his heartfelt thanks, the writer has been honoured with the inestimable privilege of inspecting authentic examples, usually type or paratypes, of very nearly all the species under notice, so that the process adopted has been an easier matter than would have been the case in the compilation of a similar work on many other faunas.\*

\* I am particularly indebted in this respect to the Trustees of the British Museum (Natural History) in the first place, and to the Directors of the Berlin, Stockholm, Stuttgart, and Vienna Museums, and, furthermore, to Colonel A. J. Peile for drawings of and notes on many radulae, to H. Watson for kind advice concerning anatomy, and to the Royal Society of South Africa for permission to republish certain text-figures which appeared originally in the Transactions of that Society.

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With regard to illustrations, the object has been to figure

- (a) All species yet unfigured.
- (b) Those of importance which have been figured either inadequately, or in publications little accessible to the average collector.
- (c) Difficult species, or such as are typical of the main groups into which others here unfigured are divided.

For small or intricate forms enlarged wash drawings have been employed, while large or simple forms, devoid of intricate detail, are illustrated by photography, and my best thanks are due to Miss Gertrude Woodward and Mr. E. J. Manley for the trouble and interest they have devoted towards making the plates successful.

The northern geographical boundaries, as in my Reference List, are the Kunene and Zambesi Rivers, and the minor geographical divisions remain the same as in that work, except for the addition of Namib and Kaokoveld to South West Africa and the elimination of the Northern Transvaal, from which most species, formerly considered to be practically confined within its limits, are now known to be more widely dispersed. Though not strictly accurate, Lorenzo Marques is still employed to embrace the entire Portuguese Territory in East Africa south of the Zambesi.

A reference is given to the original description of every species, valid or otherwise, but in the case of those included in my Reference List citation of their reference number in that list renders unnecessary repetition of all other references therein given; all later references, however, and a few that were omitted are given in full, as well as all of slightest importance to species not included in it. Much early synonymy of old, widely diffused species, of little concern to South African students, is now omitted. It may be of interest to note that of the 596 species then included as valid, 68 have since been expunged or relegated to synonymy; on the other hand, excluding a few that crept into print, so to speak, still-born, 236 have been added, making a total of 764 to be treated as valid in the following pages.

A quarter of a century has elapsed since the publication of my Revised Reference List of South African Non-marine Mollusca,\* during which period a vast amount has been added to our acquaintance with that fauna, not only from the rather unimportant standpoint of new species, though their number is considerable, but with regard to matters of greater scientific interest, the habits and development of

<sup>\*</sup> Ann. S. Afr. Mus., xi, pt. 3, pp. 59-306, pl. ii, 1912.

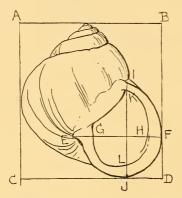
many forms hitherto little known and the extent of their distribution. But although greatly extended, our knowledge of the last is still in its infancy, which accounts for what may appear needless profusion of localities in the present volume for many of the less usual forms. It begins to appear probable that many of these are confined within a comparatively small geographical area, and only by setting forth all available records of their established occurrence, and a few, I fear, that are open to question, owing to misidentification by authors who were unacquainted with the originals and attributed to most improbable localities species they had never seen, may it be possible in this, which is after all but a pioneer work, to aid future students, on fuller acquaintance with their range, to correlate into reasonable compass the mass of data here given.

In order to avoid more confusion than possible, I have adhered fairly closely to the main systematic arrangement adopted in my Reference List, but considerable discrepancy will be observed with regard to the genera and even families in which many species are now placed. This is due in part to extended knowledge of their anatomy, and still more to the many changes necessitated by the desire to follow strict order of priority in accordance with the Laws of Nomenclature, while a definite stand is made to enforce these laws in regard to the inadmissibility of authorship being ascribed to pseudo-authors, of whom Parreyss is perhaps the most flagrant example, who were accustomed to distribute undescribed species under manuscript names of their own invention, which were subsequently adopted and wrongly credited to them by the author actually responsible for their description. I have also reverted, not without regret, to use of the original spelling of specific names except in cases of obvious misspelling (e.g. verrauxi for verreauxi) usually where the original author noticed his own error and corrected it within reasonably short time of its first publication.

In view of the lengthy bibliography given in my Reference List, there is no need for another, as the few entirely fresh publications since that epoch are either well known or cited in full where they occur in the following pages.

My method of measuring shells is shown in the two subjoined figures more concisely than by verbal explanation, but so much variation exists among different authors in this respect, especially as to the height of heliciform shells and the dimensions of the aperture, that comparison of mine with those of some others will doubtless reveal apparent discrepancies which do not really exist.

In conclusion may I explain that I disavow any conceivable claim to authority on supergeneric and anatomical subjects, and if I may for convenience in the present work have followed one author rather than another, or possibly a line of my own, without giving good reason



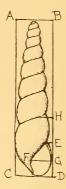
Text-fig. 1.—Heliciform shell, showing method of measuring.

A-B. Diam. maj.

diam. maj.)

A-C. Alt.
I-J. Apert. alt. extern.
K-L. Apert. alt. intern.
E-F. Apert. lat. extern.

G-H. Apert. lat. intern. (Diam. min. is that of the shell from back to front, at right angles to



Text-fig. 2.—Turriform shell, showing method of measuring.

A-C. Long. or Alt.

A-B. Lat.

E-D. Apert. alt. F-G. Apert. lat. H-D. Last whorl.

for it, I trust that my doing so will not be advanced as of the slightest weight concerning any point which may be, or become at a later date, a matter of controversy.

Postscript.—Just as the final proofs of this work were going to press, there appeared two papers, by Haas and Neveu-Lemaire respectively, which have a more or less important bearing on the present subject. The last mentioned, "Traite d'Helminthologie Medicale et Vétérinaire," Paris, 1936, is an impressive volume of 1516 pages, of which pp. 1433-1477 are devoted to a list of intermediary molluscan hosts of trematodes, refiguring all the South African shells previously figured in the paper by Germain and Neveu-Lemaire in 1926; as these figures, however, are from the same blocks as those in the earlier paper, it is unnecessary to refer more fully to them here.

Haas ("Binnen-Mollusken aus Inner-Afrika," Abh. Senckenb. Ges., No. 431, 1936) not only gives very many fresh South African localities for a large number of species, but copious notes on many of them,

particularly the Pelecypoda. In this case I have incorporated all important references from his paper and all new localities that need mention, but many of his deductions concerning the bivalves are much open to controversy, and I regret that I am unable to find myself in agreement with some of them. Rather, therefore, than open up such matters at this late stage in the completion of my own work, I have preferred to let all that I had previously written, and to which I still adhere, stand unaltered, the references to his paper showing to a great extent the chief points in which his views are at variance with my own.

### SYSTEMATIC ACCOUNT.

### SUB-KINGDOM MOLLUSCA.

### CLASS GASTROPODA.

Mollusca characterised by their asymmetrical organisation and by their well-developed head, which bears tentacles. They also nearly always have a foot adapted to creeping, a well-developed radula, and usually a shell formed of one piece and, at least in the young, spirally coiled.

#### SUB-CLASS EUTHYNEURA.

Hermaphrodite Gastropoda specially characterised by the partial detorsion of their organisation when adult, as is well manifested in the visceral commissure, which is usually not twisted and shows a tendency to the concentration of all its elements round the oesophagus. Pedal centres frequently united by a second "parapedal" commissure. Radula usually having numerous teeth in each transverse row.

#### ORDER Pulmonata.

Pallial cavity present, but no ctenidium; pallial aperture a comparatively small contracted orifice, the cavity constituting a pulmonary organ adapted for breathing air. Auricle of heart usually anterior; kidney usually with ureter; nerve ganglia concentrated round oesophagus. The hermaphrodite duct usually bifurcates to form a distinct oviduct and a vas deferens.

### SUB-ORDER Stylommatophora.

Nearly always two pairs of tentacles, invaginable, with eyes on summits of upper pair. Male and female genital orifices open into a common vestibule; suprapedal gland present.

### TRIBE AGNATHA.

No jaw; teeth of radula narrow and pointed; animal carnivorous. I retain this old-established name, though as a matter of fact it comprises an unnatural group, as the Testacellidae, though shell-bearing molluscs without a jaw, have little further connection with the first three families of the Tribe and would otherwise find a more natural place considerably lower down the scale.

#### FAMILY APERIDAE.

Characters those of the single genus, found only in South Africa. Genus  $A\,pera$  Heynemann, 1885

(Jahrb. D. Mal. Ges., xii, p. 20)

(=Chlamydephorus Binney, 1879, non Chlamydophorus "Harlan," Wagler, in Mammalia 1830).

Type C. gibbonsi Binney.

Cockerell \* has recently pointed out that the name Chlamydophorus, attributed by many writers to Harlan in 1825, was not employed by that author, whose generic name for a small Armadillo was Chlamyphorus throughout the two papers which he wrote on the subject in that year,† but overlooks that Wagler ‡ in 1830 altered Harlan's name to Chlamydophorus without giving any reason for his action, which may be therefore due either to carelessness in copying or desire to amend Harlan's originally malformed word. The name Chlamydophorus must therefore be attributed to Wagler, 1830, but this in no way affects the question as to whether it invalidates the Chlamydophorus of Binney, 1879, which it appears to me should hold good, and which I subordinate to Apera only in deference to the views of those who hold the latter to be a far more suitable name for the genus, and the names of Harlan and Wagler to be errors in spelling for Chlamydephorus.

\* Nautilus, xlviii, 1935, p. 142.

<sup>†</sup> Ann. Lyc. N.H., N.Y., i, 8, 1825, p. 237, and Zool. Journ., p. 25.

<sup>†</sup> Nat. Syst. Amphib., 1830, pp. 4, 35, 54, 55 (footnote), and 346 (index).

Animal subcylindrical, tapering gradually towards the head and more abruptly at the posterior end; two pairs of tentacles, upper retractile and bearing the eyes, lower small and beneath them a pair of short processes of paler colour. Back usually rounded, but occasionally with lateral keels. No caudal mucous pore; pallial organs towards hinder end of back, but both the mantle and the degenerate cap-shaped shell are sunk beneath the skin, the latter lying in a little pocket behind and to the left of the respiratory orifice. This forms a conspicuous opening just to the right of the mid-dorsal line towards the posterior end, and has dermal grooves radiating from it; the common genital opening is in the right side of the head. Pedal gland lying free in the body-cavity and exceptionally large; jaw absent, radula long, of the same general type as in the other carnivorous families but varying in the different species; reproductive organs comparatively simple.

Watson's arrangement of the species is here followed.

### Apera gibbonsi (Binney). Ref. List No. 2.

1879. Chlamydephorus gibbonsi Binn., Bull. Mus. Comp. Zool. Harvard, v, p. 331, pl. ii, f. a, b. D.F.

1915. Apera gibbonsi Binn., Wats., Ann. Natal Mus., iii, p. 193, pl. vii, f. 1-2; pl. viii, f. 14-15; pl. xvii, f. 91-92; pl. xx, f. 125; pl. xxi, f. 129; pl. xxiii, f. 143. D.F.A.R.

Animal slender, tapering acutely to the rear, back rounded, skin coarsely reticulated, dorsal grooves usually about 1 mm. apart, but united in front of respiratory opening, lateral grooves irregular, radial conspicuous, some being forked; oblique sublateral grooves also conspicuous and rather numerous. Ground colour normally orange-yellow mottled with brown, a paler band, very sparingly mottled, along centre of back. The largest specimen measured by Watson is

Long. 66.5, lat. max. 12.5; alt. 12.5; foot-sole lat. 5.0 mm.

Shell  $4 \times 2.5$  mm., usually thick, depressed, with apex in front of posterior margin; sinus deep.

Radula as much as 21 mm. in length, formula  $(37 + 1 + 38) \times 60$ .

Hab. NATAL. Umgeni Valley (type, Gibbons); Pietermaritzburg (? Burnup, Ponsonby).

ZULULAND. Hlabisa (Burnup).

Type in Academy of Natural Science, Philadelphia.

# Sub-species rubella Watson.

1915. Apera gibbonsi rubella Wats., Ann. Natal Mus., iii, p. 197, pl. vii, f. 3-5; pl. viii, f. 16-17; pl. ix, f. 27; pl. x, f. 32-33; pl. xiii, f. 41-42, 52; pl. xiv, f. 63-65, 67; pl. xv, f. 70, 77-79; pl. xvii, f. 93-98; pl. xx, f. 126; pl. xxi, f. 130; pl. xxii, f. 138-139, 142; pl. xxiii, f. 144–145, 150. D.F.A.R.

Animal broader than type, tapering more abruptly at hinder end, reticulation of skin very similar but not so coarse, the grooves being more numerous and

less deep. Colour reddish brown above, thickly mottled with dark grey, a paler band along middle of back, sides reddish orange, foot-sole paler. Largest specimen examined by Watson

Long. 67.0, lat. max. 13.5; alt. 13.25; foot-sole lat. 6.0 mm.

Radula without central tooth, formula  $(28+0+28)\times 51$  and  $(34+0+35)\times 48$ ; cusps very strongly curved, slightly broader towards the point.

Hab. NATAL. Equeefa (type); Durban (Burnup). Type in Natal Museum.

### Sub-species gracilis Watson.

1915. Apera gibbonsi gracilis Wats., Ann. Natal Mus., iii, p. 199, pl. vii, f. 6; pl. xiii, f. 43; pl. xix, f. 123. D.F.A.R.

Animal more slender than type, tapering to a very acute angle at hinder end, reticulation of skin coarse, as in type, body rather sparsely mottled with brown, but the patches of colour extend across the back, so that there is no paler dorsal band. Shell rather longer, and narrower behind than in the other forms; radula with no central tooth and fewer laterals; formula  $(19+0+20) \times 34$ .

Hab. NATAL. Equeefa (Burnup). Type in Natal Museum.

### Sub-species lupata Watson.

1915. Apera gibbonsi lupata Wats., Ann. Natal Mus., iii, p. 200, pl. viii, f. 18-19; pl. xiii, f. 58; pl. xvii, f. 99; pl. xix, f. 124. D.F.A.R.

Animal intermediate between rubella and the typical form both in shape and reticulation, being generally a little broader and less coarsely reticulate than the latter and a little narrower and less finely reticulate than the former; colour variable, sometimes dark like rubella, sometimes light as in gibbonsi s.s. Normally the mottling is inconspicuous and there is only slight trace of the paler dorsal band. Long. 46·0, lat. max. 7·5; alt. 7·0; foot-sole lat. 4·0 mm.

Shell much depressed; radula with a comparatively small number of very large teeth, central typically absent, cusps somewhat curved and conspicuously barbed on lower side; formula  $(20+0+20)\times 44$  and  $(21+0+21)\times 38$ .

Hab. NATAL. Port Shepstone (Burnup).

Type in Natal Museum.

### var. duplex Watson.

1915. Apera gibbonsi lupata var. duplex Wats., ibid., p. 201. D.R.

Animal coloured very similarly to *gibbonsi* s.s. Cusps of teeth rather longer than in *lupata* typica and having an additional barb on the upper side near the point of the larger teeth; formula  $(22+1+22)\times 42$ .

Hab. CAPE PROVINCE. Port St. John's (Mrs. Warren). Type in Natal Museum.

# Apera parva Watson.

1915. Apera parva Wats., ibid., p. 202, pl. viii, f. 22-23; pl. ix. f. 28; pl. xiii, f. 44-45, 53; pl. xvii, f. 100-102; pl. xxi, f. 131; pl. xxiii, f. 146. D.F.A.R.

Animal very slender, tapering to an acute angle at hind end, back rounded, skin coarsely reticulate, dorsal grooves about  $\frac{1}{3}$ rd mm. apart, but united in front of respiratory opening, lateral grooves near dorsal and extending forwards to the head, the right one ending in the genital opening, radial grooves well marked but fewer than usual, only three on each side in addition to the two median; oblique sublateral grooves less numerous than in gibbonsi and absent from the anterior third of animal.

Length in life 35 mm. and colour fawn, dark above and lighter below; dimensions in spirit: Long. 25.0, lat. max. 3.0; alt. 3.0; foot-sole lat. 1.9 mm.

Shell  $1.6 \times 0.9$  mm., thick, depressed, apex in front of posterior margin. Radula 8 mm. long, central tooth very small, absent from some rows; other teeth much alike in shape, gradually increasing in size and becoming very large towards the edges of the radula; cusps simple, very slightly curved, bases broader than in qibbonsi.

Hab. CAPE PROVINCE. Fern Kloof, Grahamstown (Farquhar). Type in Natal Museum.

### Apera dimidia Watson.

1915. Apera dimidia Wats., ibid., p. 204, pl. vii, f. 7-9; pl. viii, f. 20-21, 24; pl. ix, f. 29; pl. xi, f. 34-35; pl. xii, f. 36-39; pl. xiii, f. 40, 46, 54, 59-62; pl. xiv, f. 66, 68-69; pl. xv, f. 71, 73, 75; pl. xvi, f. 80-86, 88-90; pl. xvii, f. 103-107; pl. xviii, f. 115-122; pl. xx, f. 127; pl. xxi, f. 132; pl. xxii, f. 136-137, 140-141; pl. xxiii, f. 147, 151. D.F.A.R.

Animal sometimes swollen towards the middle, tapering to a blunt point at hind end, back rounded, skin covered with a network of grooves, dorsal about 1 mm. apart, usually separated by a double row of rugae but united in front of respiratory opening, lateral rather near dorsal, irregular; oblique sublateral also irregular, less numerous than in gibbonsi, usually absent from anterior third of animal; radial fairly well marked dorsally. Body yellowish white, conspicuously mottled with greyish brown, which chiefly forms a somewhat discontinuous dark band along each side, with a much paler, only slightly mottled dorsal area between

Long. 33.5, lat. 7.5; alt. 6.5; foot-sole lat. 4.25 mm.

Shell  $3 \times 1.8$  mm., thin and translucent, convex, apex round, quite at posterior end. Radula 4.8 mm. long, central tooth absent, about 13 laterals on each side, with very short curved cusps, and same

number of marginals, with longer, narrower cusps; formula  $(25+0+26)\times 61$ .

Hab. NATAL. Port Shepstone (type); Equeefa (Burnup); Town Bush, Pietermaritzburg (Mrs. Warren).

Type in British Museum.

### Apera purcelli Clige.

#### Ref. List No. 4.

1901. Apera purcelli Clige., Ann. S.A. Mus., ii, p. 230, pl. xiv, f. 1-2. D.F.

1915. Apera purcelli Cllge., Wats., Ann. Natal Mus., iii, pp. 112, 207, pl. viii, f. 25; pl. xiii, f. 47–48, 55. N.D.F.A.R.

Animal rather broad anteriorly, tapering to a blunt point at hind end, back rounded; skin with well-marked reticulation, rugae rather large for size of slug. Dorsal grooves less than  $\frac{1}{2}$  mm. apart, separated throughout by a single row of rugae, radial well developed, extending down to the single peripodial groove; practically no trace of lateral grooves, but irregular oblique grooves in front of the radial correspond to the sublaterals of other species. Body dark grey or bluish black, an obscure slightly darker band along each side, dorsal area less dark and lower portion much paler. The type was said to be 25 mm. long, footsole 4 mm. broad.

Shell very convex, apex rounded, overhanging posterior margin to a considerable extent. Teeth of radula less numerous than in most species, central small, 3 or 4 laterals on each side with very short cusps and about four times as many marginals with longer, narrower cusps; formula of immature specimen  $(18+1+18) \times 41$ .

Hab. CAPE PENINSULA. Table Mountain (Lightfoot; Barnard). Type in South African Museum.

# Apera burnupi Smith.

#### Ref. List Nos. 1 and 3.

1892. Apera burnupi Smith, A.M.N.H., x, p. 466. D.

1900. Apera natalensis Cllge., Ann. S.A. Mus., ii, p. 3, pl. i, f. 3–4; pl. ii, f. 14–15. D.F.A.

1901. Apera natalensis Clige., Srth., Naturw. Wochenschr., xvii, p. 111, f. 7. A.

1909. Apera natalensis Clige., Srth., Tierreich, iii, pp. 143, 611 (1912), pl. iv, f. 9–10. A.

1915. Apera burnupi Smith (=natalensis Cllge.), Wats., Ann. Natal Mus., iii, pp. 110, 111, 210, pl. vii, f. 10–11; pl. viii, f. 26; pl. ix, f. 30; pl. xiii, f. 49, 56; pl. xvii, f. 108–109; pl. xxi, f. 133; pl. xxiii, f. 148. N.D.F.A.R.

Animal broad and flattened towards hind end, tapering anteriorly, with two longitudinal keels on each side, upper blunt but prominent especially posteriorly, meeting in an obtuse angle above posterior end of foot, lower less prominent, not very far from edges of foot and not extending to hind end. Skin coarsely reticulate, dorsal grooves conspicuous, about 1 mm. apart, separated throughout by a row of rugae which is usually double in the middle of the body, lateral deep but rather irregular, and below each of them another groove branches from the anterior radial, running forward above the lower keel until uniting with lateral on the side of head; two or three sublateral and three or four supralateral grooves on each side; radial grooves rather numerous and very conspicuous, while there is an obscure longitudinal groove on the foot-fringe.

Body orange-red, darker above and mottled with patches of greyish brown, chiefly emphasised between the keels. The largest example in the South African

Museum measures

Long. 77·0, greatest breadth between upper keels 17·0, alt. max.  $14\cdot0$ ; foot-sole lat.  $11\cdot5$  mm.

Shell  $5.5 \times 3.2$  mm., convex, with conical apex projecting slightly beyond posterior margin. Radula 6 mm. long, central tooth with very short single cusp, 11 laterals on each side with short double cusps and more than twice as many marginals with long, narrow, nearly straight cusps, transition between laterals and marginals abrupt; formula  $(25+11+1+11+25)\times 77$ .

Hab. NATAL. Pietermaritzburg (burnupi, Burnup); Richmond (natalensis, Ward, Warren).

Type of burnupi in British, natalensis in South African Museum.

# $Apera\ sexangula\ {\it Watson}.$

(Pl. xiv, f. 4.)

1897. Apera burnupi Smith, Cllge., A.M.N.H., xx, p. 221, pl. v, f. 1-6. A.

1898. Apera burnupi Smith, Pilsb., Nautilus, xii, p. 12. N.

1900. ,, ,, Cllge., Ann. S.A. Mus., ii, p. 4, pl. i,

f. 5-6. N.F.

1901. Apera burnupi Smith, Cllge., J. of Mal., viii, p. 71, f. 1. A.

1902. ,, ,, ,, ix, pl. vi, f. 66. A.

1910. ,, ,, ,, Ann. Natal Mus., ii, p. 166. D.

1912. ,, ,, Srth., Tierreich, iii, p. 611, pl. iv (1909), f. 11. A.

1915. Apera sexangula Wats., Ann. Natal Mus., iii, pp. 114, 213, pl. vii, f. 12–13; pl. ix, f. 31; pl. xiii, f. 50–51, 57; pl. xv, f. 72, 74, 76; pl. xvi, f. 87; pl. xvii, f. 110–114; pl. xxi, f. 134; pl. xxii, f. 135; pl. xxiii, f. 149. N.D.F.A.R.

Animal rather slender, roughly hexagonal in section owing to presence of 2 prominent longitudinal keels on each side, the upper apart about three-fifths the total breadth and nearly parallel, uniting in an acute angle at the hind end; body

tapering to an acute angle posteriorly, rugae minutely subdivided; dorsal grooves well marked, about 1 mm. apart, separated throughout by a row of rugae which often becomes irregularly double towards the middle, lateral grooves conspicuous, the right ending in the genital opening, sublateral few and irregular, only 2 or 3 on each side, radial well marked, terminating below, as do the sublaterals, in a longitudinal groove, parallel to the peripodial, but separated from it by a narrow row of rugae. Colour chestnut or reddish brown, paler on keels and foot, mottled with greyish brown, more concentrated towards the rear, and usually with numerous reddish-brown specks on body and foot-sole. A large example in the Natal Museum measures

Long. 77·0, lat. max.  $16\cdot0$ ; alt.  $15\cdot5$ ; foot-sole lat.  $10\cdot5$  mm.

Hab. NATAL. Port Shepstone; Hilton Road (Burnup). CAPE PROVINCE. Grahamstown (Farquhar; French).

Type in British Museum.

Shell convex, laterally compressed, with conical apex projecting considerably beyond posterior margin. Radula 4 or 5 mm. long, central tooth with a short, broad, single cusp, 8 or 9 laterals on each side with short double cusps and more than twice as many marginals with longer, narrower ones, the transition being rather abrupt; formula  $(23+9+1+9+23)\times 63$ .

Easily distinguishable from burnupi, with which it was for long confused, through the upper keels meeting in an acute angle instead of a curve, and the lower extending to the hind end of the animal instead of only <sup>3</sup>/<sub>4</sub>ths the length.

### FAMILY STREPTAXIDAE.

Agnathous snails of elongate or helicoid form, frequently with aperture more or less obstructed by tooth-like processes, shell unicoloured and except in exceedingly rare instances, when in fresh condition, hyaline, glossy or slightly silky, colourless or palest olivaceous. Animal red, green, or yellow.

The arrangement which follows is that adopted by Pilsbry (Bull. Amer. Mus., xl, 1919).

Sub-Family Streptaxinae.

Streptaxidae with distorted axis, or, if not distorted, with broad dome-shaped summit; little or no apertural dentition.

Genus Gonaxis Taylor, 1877 (Q.J. of C., i, p. 252). Type G. gibbonsi Tayl.

Shell asymmetrical; in early stages heliciform, after which the axis becomes more or less strongly deflexed, so that the summit is

thrown backwards to the left in frontal aspect; aperture seldom with more than one (parietal) tooth.

Between 1876 and 1881 Kobelt published a treatise under the title of Illustriertes Conchylienbuch, in which he dealt briefly and systematically with the accepted genera of that period, and in many cases gave what would seem at first glance to be very definite designations of their genotype, one being the section Odontartemon Pfr.,\* with "Typus Streptaxis distortus Jonas," and H. B. Baker † has claimed that by reason of this designation Pfeiffer's unwieldy name should take priority of Gonaxis. Kobelt states in his preface, however, that his work is intended "für die Bedürfnisse des Sammlers und für Schulbibliotheken," and it seems to be almost universally accepted that the word Typus, as applied by him in this treatise, is not intended to designate the actual type, but rather a typical example of the genus implicated. This is certainly the view held by most of Kobelt's compatriots, and neither Thiele nor Pilsbry have taken the types of Ill. Conch.-Buch into account in their recent writings, while Kobelt himself stultified his earlier designation in 1910, in his Kat. Agnatha (Jahrb. Nassau. Ver. Naturk, lxiii, p. 149), when he omitted S. distortus entirely from his list of Odontartemon, of which he designated eburneus Pfr. as type and restricted its distribution to south and eastern Asia. If, however, the types of the Ill. Conch.-Buch are eventually recognised and the practically lost species distortus Jonas definitely determined, Odontartemon will probably have to replace the name of the genus or sub-genus to which distortus is proved to belong.

### Group 1. Shell strongly sculptured.

Gonaxis kirki (Dhrn.).

1865. Streptaxis kirki Dhrn., P.Z.S., p. 232. D.

1905. ,, (*Gonaxis*) kirkii Dhrn., Kob., Conch. Cab., p. 8, pl. xlii, f. 14-15. D.F.

1925. Gonaxis kirki Dhrn., Conn., Trans. R. Soc. S. Africa, xii, p. 110. N.

Shell small, subrhomboid, umbilicate, dull and silky. Spire distorted, apex, which is obtusely convex, inclined so far backward as to be just obscured from frontal view. Whorls 6, moderately convex, first 4 rapidly, last 2 gradually increasing, extreme apex 1 whorl, smooth and glossy, remainder covered with fine, close, regular, curved, slightly oblique costulae, which become more or less weak on front of last whorl, the intervals between them cut by microscopic spiral

<sup>\*</sup> Mal. Blätt., ii, 1856, p. 172.

<sup>†</sup> Nautilus, xli, 1928, p. 127.

lines; suture simple, well defined. Aperture oblique, roundly quadrate, peristome white, glossy, narrowly expanded, labrum sharply receding, columella concave, margin narrowly reflexed, half concealing the narrow umbilicus, which extends to the apex, dentition none. A typical example from Mtisherra measures

Long. 8·0, lat. 6·4; apert. alt. 3·2, lat. 2·7; last whorl, obliquely from centre of upper suture to eentre of base 6·7, vertically from eentre of base to upper suture 5·7 mm., these last two figures giving some idea of the extreme axial distortion: a shorter example of the same series is 7·6, and a longer one from Chimoio district 9·0 mm. in length, though all are equal in breadth.

Hab. LORENZO MARQUES. Mtisherra R. Valley; Chimoio District (Cressy).

Type in British Museum.

A well-sculptured shell of moderate size, with extremely distorted axis; it was described from Mumba I., Lake Nyasa, and is considered by Germain as probably identical with the Kenyan species woodhousei and percivali Preston, all of which are certainly nearly akin.

Group 2. Shell nearly smooth.

### Gonaxis gwandaensis (Prest.). Ref. List No. 6.

1912. Streptaxis gwandaensis Prest., A.M.N.H., ix, p. 69, f. 1. D.F. 1925. Gonaxis ,, ,, Conn., Trans. R. Soc. S. Africa, xii, p. 110. N.

Shell comparatively large, subrhomboid, umbilicate, thin, nearly smooth, glossy, transparent, pale olivaceous. Spire distorted, the axis being inclined to the right, and both sides to the left; apex depressedly conieal. Whorls 6, 4th and 5th convex, remainder flattened, the first 4, forming the apex, small, 5th large, inflated on the left, 6th also large, flattened in front; first 3 smoothly punctate, remainder sculptured with fine, close, regular, straight, oblique transverse striae, evanescent below the periphery and most prominent in the narrow erenulate suture. Aperture quadrate, base not much rounded, making almost a right angle at its junction with the columella; peristome white, glossy, and reflexed, labrum advancing slightly for 2 mm. below the suture and then sharply receding; columella erect, margin broadly reflexed, half covering the rather narrow umbilicus; callus white and rather thick. Shell described, from Wanetsi R. in Natal Museum, measures

Long. 16·1, lat. 11·2; apert. alt. 4·7, lat. 5·5; last whorl 13·4 mm.

Hab. S. RHODESIA. Near Geelong Mine, Gwanda District (type, S. B. Cox).

LORENZO MARQUES. Wanetsi River, Majude District (Bell Marley).

Type in Tervueren Museum.

Perfectly figured by Preston and only known as yet from the abovementioned localities. Gonaxis cressyi Conn.

1922. Gonaxis cressyi Conn., A.M.N.H., x, p. 113. D.

1925. ,, ,, ,, Trans. R. Soc. S. Africa, xii, p. 110, pl. iv, f. 1. N.F.

1936. Gonaxis cressyi Conn., Beq. and Clench, J. of C., xx, p. 266. N.

Shell very small, narrowly rimate, oval, smooth, glossy, transparent. Spire short, sides parallel, axis almost straight, slightly bent back at the bluntly pointed apex, which is only just visible from the front. Whorls 6, moderately convex, the last less rounded than its predecessor, almost flat in front; first  $2\frac{1}{2}$  engraved to apex with fine, close, regular, microscopic spiral lines, which are present on the base of immature shells, and faintly so on the later whorls, which are practically smooth except for strong, regular crenulation just below the sutures. Aperture quadrate, rounded at base, peristome white and shining, narrowly reflexed, labrum slightly receding, dentition none.

Long. 6·2, lat. 3·8; apert. alt. 2·2, lat. 2·0; last whorl  $4\cdot 5$  mm.

Hab. LORENZO MARQUES. Mtisherra River Valley (type); Dondo; Zangwe Basin (Cressy).

Type in British Museum.

Nearest to the Central African G. gibbonsi Taylor, but in that species the apex is almost concealed from frontal view owing to the backward distortion of the volution. Bequaert and Clench suggest identity with G. mozambicensis (Smith), which has a far more oblique, less vertical spire.

Sub-genus Afristreptaxis Thiele, 1932. (Arch. f. Moll.-K., lxiv, p. 12).

Type Streptaxis vosseleri Thiele.

Created for the African species formerly ranged under *Eustreptaxis* Pfr., which has been shown, by reason of Kobelt's designation of *contusus* Fér. as type in 1910, to become a synonym of *Streptaxis* s.s.

Large, usually smooth shells, with sides almost regular and very little axial distortion.

# Gonaxis elongatus (Fulton).

1899. Streptaxis elongatus Fulton, Proc. Mal. Soc., iii, p. 302. D.F. 1925. Gonaxis (Eustreptaxis) elongatus Fulton, Conn., Trans. R. Soc. S. Africa, xii, p. 112, pl. v, f. 1-3. N.A.R.

1936. Gonaxis elongatus Fulton, Beq. and Clench, J. of C., xx, pp. 266, 272. D.F.

Shell comparatively large, rimate, rounded oblong, smooth, glossy and transparent. Spire produced, sides parallel, apex deflected backwards to the right. Whorls 7, rapidly increasing, first  $2\frac{1}{2}$  engraved with moderately close, regular, microscopic spiral lines, remainder covered all over with close, regular, nearly straight, rather oblique transverse costulae, fainter on front of body whorl and

cut throughout by a continuation of the early spiral sculpture; suture simple, well defined. Aperture nearly square, peristome moderately reflexed, dentition consisting of a small, acute, straight parietal tooth 1.8 mm. in length, and an inconspicuous columellar fold, encircling the rima, well within the aperture. The specimen described measures

Long. 25·1, lat. 14·6; apert. alt. 10·6, lat. 7·0; last whorl 17·8 mm., but the

length varies from 23 to 28 mm.

Hab. LORENZO MARQUES. District north of Macequece (Cressy).

S. RHODESIA. Vumbu (or Vumba) Mts., Umtali (Arnold); Mt. Silinda (Sandground).

Type, described from an unknown locality, in British Museum.

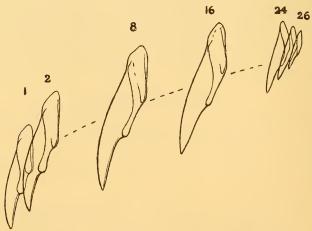
The parietal tooth appears to be formed after maturity; young shells are clearly perforate to the apex.

The foot-sole is undivided and there are no peripodial grooves; hind end of foot bluntly pointed, no keel, but a median posterior groove present; lower tentacles apparently bifid; radula (of immature animal)  $8\cdot 4\times 1\cdot 4$  mm., teeth all unicuspid, of aculeate form, fairly uniform in shape, gradually increasing in size from 1–6 and decreasing from 10th tooth to margin; no central tooth; formula  $(24+0+24)\times 86$ .

Gonaxis vengoensis Conn.

(Text-fig. 3.)

1922. Gonaxis (Eustreptaxis) vengoensis Conn., A.M.N.H., x, p. 114. D.



Text-fig. 3.—Gonaxis vengoensis Conn., Macequece. Representative teeth from the radula; ×100.

1925. Gonaxis (Eustreptaxis) vengoensis Conn., Trans. R. Soc. S. Africa, xii, p. 115, pl. iv, f. 2. D.F.A.R.

Shell comparatively large, oval, smooth and glossy on front, less so on back. Spire produced, left side convex, right nearly straight, apex roundly conoid. Whorls  $6\frac{1}{2}$ , rather flat, first  $2\frac{1}{2}$  microscopically malleate and engraved with strong, close, regular, spiral lines, remainder covered with close, regular, straight, rather oblique costulae, the intervals between which are divided by the spiral lineation into rows of microscopic tubercles, and which become very weak on front of body whorl. Aperture quadrate, peristome slightly thickened, dentition none.

Long. 25.2, lat. 14.6; apert. alt. 8.8, lat. 8.6; last whorl 19.5 mm.

Hab. LORENZO MARQUES. District 15 miles north of Macequece (Cressy).

Type in British Museum.

Easily distinguished from the last species by absence of the parietal tooth; the animals are very similar and radulae remarkably alike, the increase in size being from 1 to 6 and decrease from No. 13 outwards; formula  $(26+0+26) \times \text{about } 80$ .

Sub-Family Ptychotrematinae (= Enneidae and Enneinae Auctt.).

More or less elongate shells with straight axis and undistorted spire; usually with apertural dentition.

Genus *Streptostele* Dhrn., 1866 (Mal. Blätt., xiii, p. 128).

Slender shells with more or less regularly tapering spire and, typically, practically no dentition.

Sub-genus Raffraya Bgt., 1883 (Ann. Sci. Nat. Zool., xv, p. 66) (= Ischnostele C. Bttg., 1915).

Type Raffraya milne-edwardsi Bgt.

Outer lip obtusely toothed or thickened within above the middle; a small angular tubercle.

Streptostele herma Conn.

Ref. List No. 111.

1912. Streptostele herma Conn., Ann. S.A. Mus., xii, p. 89, pl. ii, f. 3. D.F.

Shell very small, elongate, narrowly rimate, slightly glossy, translucent, milky olivaceous. Spire produced, tapering, very narrow, apex rounded. Whorls 7, VOL. XXXIII.

gradually increasing, little convex, but impressed at the suture, first 2 smooth, remainder sculptured with rather coarse, irregular, nearly straight striae; suture deep. Aperture short, piriform, virtually edentate, the two processes being an almost imperceptible parietal callosity and an incurvation of outer lip about one-third of its length below the suture; peristome not thickened, thinly reflexed.

Long. 4.5, lat. 1.3; apert. alt. 0.9, lat. 0.8; last whorl 1.5 mm.

Hab. S. RHODESIA. Victoria Falls (Connolly).

Type in British Museum.

The only known S. African member of a tropical genus which extends to Abyssinia and over the Mascarene Islands; S. unidentata Conn., likewise described from the Victoria Falls, has only been collected on the north bank of the Zambesi.

Genus Gulella Pfr., 1856 (Mal. Blätt., iii, p. 173) (=Ennea auctt., non H. & A. Adams).

Type Pupa menkeana Pfr.

As shown by Pilsbry in 1919, the type of *Ennea*, elegantula Pfr., is a *Ptychotrema*, a genus not yet recorded from South Africa, with one or more long grooves round the outer surface of the last whorl; *Ennea* therefore becomes a sub-genus of *Ptychotrema*, and *Gulella* must be adopted for the widespread circumtropical genus to which most of the South African Streptaxidae belong.

The shell is usually rather small, elongate, cylindrical or ovate, rimate, thin, transparent, pale olivaceous, the aperture in South African species bearing at least one lamella on the paries, and usually a varying number of plaits or denticles on peristome and columella, which on base and labrum frequently correspond to a small pit or depression on the outer wall of the shell, but do not enter deeply in the form of a thread, causing an external spiral furrow on the body whorl, as in the tropical genus *Ptychotrema*.

Although recent knowledge proves that certain species are liable to extraordinary variation in size and form, apertural dentition, for the most part, is fairly constant and offers the most reliable basis for dividing the otherwise unwieldy medley of material into more or less homogeneous groups, which can be further simplified by separating those species with normally well-defined striation from those that are practically smooth; while, in spite of variation in individual size, I find it convenient for purpose of speedy determination to segregate the minutiae, roughly up to about  $3\frac{1}{2}$  mm. in length, from those of average greater size. Of utmost importance,

too, is the scheme, single or duplex, of the columellar dentition. It is on these principles, therefore, that I offer the subjoined arrangement, in hope that it may facilitate the study of this intricate genus.

Few of the South African Gulellae can be allotted to any particular section that has already received a distinguishing name, and I see no necessity for creating more; my suggested arrangement is as follows:—

A. Columellar process single, only one plait or tooth on columella.

Group 1 (*Uniplicaria* Pfr.). Aperture large and open, with a single lamella on right of paries.

planti Pfr.

Group 2 (Paucidentina Mts.). Aperture large and open, little obstructed by weak denticles; shell usually smooth and fusiform.

natalensis Crvn. zuluensis Conn. pondoensis Conn. queketti M. & P. triglochis M. & P.

Group 3 (including *Huttonella* Pfr.). Aperture in this and all subsequent groups comparatively smaller, dental processes thus appearing more prominent; dentition 3- or 4-fold, one process on paries, one on labrum, one on columella, and occasionally one on base, which is not always present in shells of the same species.

(i) More or less strongly striate:

infans Crvn., 3 teeth. tristãoensis Conn., 3 teeth. rogersi M. & P., 3 teeth. candidula Morel., 3 teeth. hickeyana M. & P., 3 teeth. praelonga Conn., 3 teeth. crassilabris Crvn., 3 teeth. johannesburgensis M. & P., 3-4 teeth. miniata Krs., 4 teeth. rhodesiana Conn., 4 teeth. sibasana Conn., 4-5 teeth. drakensbergensis M. & P., 4 teeth.

(ii) Practically smooth, except in some cases for a short way below the suture:

perspicua M. & P., 3 teeth. kraussi Pfr., 4 teeth. subkraussi Conn., 4 teeth. juxtidens M. & P., 4 teeth. digitalis Conn., 4 teeth. nepia Conn., 3 teeth. magnolia Conn., 3 teeth. (ii, a) Minutiae:

inhluzaniensis Bnp., 3 teeth.
perspicuaeformis Stur., 3 teeth.

pentheri Stur., 3 teeth. bowkerae M. & P., 4 teeth.

Group 4 (Gulella s.s.). Dentition 5-fold, one tooth each on paries, base, and columella, and two on labrum.

(i) More or less strongly striate:

menkeana Pfr.

delicatula Pfr.

albersi Pfr.

aperostoma M. & P.

calopasa M. & P.

pfeifferi Küst.

consobrina Ancey.
orientalis Conn.

caryatis M. & P. premnodes Stur., labral tooth hardly

framesi Bnp.
subframesi Conn.

bifid.

minuta Morel.

(i, a) Minutiae:

isipingoënsis Stur.

(ii) Practically smooth:

lissophanes M. & P.

instabilis Stur. kosiensis M. & P.

maritzburgensis M. & P.

obovata Pfr.

polita M. & P.

ingens Stur.

burnupi M. & P. (contour fusiform)

planidens Mts.

barbarae Conn. (columellar process occasionally duplex).

(ii, a) Minutiae:

columnella M. & P.

bushmanensis Bnp. fraudator Conn.

mooiensis Bnp.

Group 5. Dentition more or less 6-fold, there being three teeth on labrum, either separate (gouldi) or the two upper more or less closely united (pretoriana).

(i) More or less strongly striate:

gouldi Pfr.

pretoriana Conn.

crossleyana M. & P.

tridens Conn.

(i, a) Minutiae, in which all labral teeth are united in a single large process:

arnoldi Stur. claustralis Conn.

phyllisae Bnp.

(ii) Practically smooth:

xysila M. & P. (sculptured below sutures). sexdentata Mts. aliciae M. & P.

alutacea Conn

Group 6. Dentition 6-fold, but only two central teeth on labrum, and a minute denticle near top of labral sinulus.

(i) More or less strongly striate:

warreni M. & P. cairnsi M. & P. pulchella M. & P. genialis M. & P. distincta M. & P. vallaris M. & P.

(ii) Practically smooth: penningtoni Bnp.

Group 7. As above, but no denticle in sinus, and a minute tubercle on centre of paries.

perplexa Conn.

Group 8. Dentition 7-fold, five teeth as in Group 4, plus denticles on sinus and centre of paries.

- (i) More or less strongly striate: separata Stur.
- (ii) Practically smooth: zelota M. & P.

Group 9. Dentition irregular, owing to presence of additional denticles.

(i) More or less strongly striate:

enneodon Conn.

perissodonta Stur.

Group 10 (Molarella Conn.). Columellar lamella strongly bifid. darglensis M. & P. (smooth or striate).

Group 11 (Plicigulella Pilsb.). Columellar lamella strongly triplicate.

vicina Smith.

aprosdoketa Conn.

B. Columellar process duplex, there being a superficial slab, denticle, or tubercle, usually in addition to the basal process, more or less high on the columellar margin, as well as the more deeply immersed columellar lamella.

Group 12. Dentition 6-fold; as in Group 4, plus the extra columellar process.

(i) More or less strongly striate:

pentodon Morel. phragma M. & P.
euthymia M. & P. godfreyi Bnp.
falconi Bnp. swaziensis Conn.
tripodium Conn.
linguidens Conn. (only one tooth on labrum).

(i, a) Minutiae:

connollyi M. & P. (columellar process sometimes single).

ponsonbyi Bnp.

bassetti Bnp.

viae Bnp.

(ii) Practically smooth:

himerothales M. & P. umzimvubuensis Bnp. (beaded multidentata Stur. (with additional minute denticles).

(ii, a) Minutiae:

mariae M. & P. sylvia M. & P. melvilli Bnp.

Group 13. Minute, with 4-5 teeth, 1 or 2 superficial tubercles on columellar lip.

elliptica M. & P.

Group 14. Dentition 7-fold, three more or less distinct labral denticles.

leucocion Conn.

Group 15. Dentition roughly 6-fold, the two upper labral teeth forming a large polymorphic slab, bearing occasionally one or more small cusps; lowest labral present.

(i) More or less strongly striate:

adamsiana Pfr. wahlbergi Krs. auris-leporis M. & P.

(ii) Practically smooth:

formosa M. & P. (beaded suture). daedalea M. & P. infrendens Mts.

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Group 16. With two distinct denticles on labrum and one in sinulus

(i) More or less strongly striate:

regularis M. & P.

dunkeri Pfr.

Group 17. With process on centre of paries.

(i) Strongly striate:

mfongosiensis Bnp. (tubercle on paries).

(ii) Practically smooth:

puzeyi Conn. (horizontal bar on paries).

Group 18. Labral process a single, very large polymorphic slab; other processes variable.

(i) More or less strongly striate:

crassidens Pfr. craterodon M. & P. (no basal denticle) harriesi Bnp.
munita M. & P.

contingens Bnp.

tharfieldensis M. & P. (normally with parietal denticle).

(ii) Practically smooth: rumpiana Conn.

(ii, a) Minutiae:

farquhari M. & P.

chi Bnp.

Group 19. With additional slab immersed beneath that on labrum.

contraria Conn.

A. Columellar process single.

GROUP 1.

Section Uniplicaria Pfr., 1856

(Mal. Blätt., ii, p. 173).

Type Ennea cerea Dkr.

Gulella planti (Pfr.).

Ref. List No. 87.

1855. Ennea planti Pfr., Mal. Blätt., ii, p. 173. D.

1904. ,, ,, Kob., Conch. Cab., p. 178, pl. xxii, f. 23-24. D.F.

1914. Ennea planti Pfr., Dautz. & Germ., Rev. Zool. Afr., iv, p. 11. L.

1920. Ennea (Uniplicaria) planti Pfr., Germ., Voy. Babault, p. 65. D.

Shell large, acuminate oval or cylindriform, rimate, transparent, with silky gloss, pale olivaceous. Spire produced, summit broadly rounded. Whorls  $8\frac{1}{2}$ , nearly flat, gradually increasing, first  $2\frac{1}{2}$  smooth, remainder sculptured with close, regular, nearly straight oblique striae and, under very high magnification, extremely fine, close microspiral lines, so weak as to be negligible; suture simple, shallow. Aperture trigonal, rounded at base, peristome white, glossy, narrowly expanded, sinus varying in prominence, but usually forming a slight swelling, almost a tubercle, at its base; there is a small, shortly entering angular fold, but none on the columella, which is deflected to the right half-way up, to form a deep-set oblique ridge at its upper angle. Specimens measured run from 16·0 to 21·0 in length and 8·5 to 10·0 in breadth, apert. alt. (intern.) about 2·6, lat. 3·2; last whorl from 8·4 to 10 mm.

Hab. NATAL (type, Plant). Widely distributed over the southern districts.

CAPE PROVINCE. Port Elizabeth (?) (Babault, fide Germain). Type in Stettin Museum.

#### GROUP 2.

Paucidentina Mts.,\* as restricted by Pilsbry † to shells of more or less oval form with small teeth, little obstructing the aperture; type Ennea ovalis Thiele.

### Gulella natalensis (Crvn.). Ref. List No. 74.

1880. Ennea natalensis Crvn., P.Z.S., p. 619, pl. lvii, f. 7. D.F. 1932. Gulella ,, ,, Conn., Ann. Natal Mus., vii, p. 80. N.F.

Shell of fair size, acuminate oval, nearly smooth. Sides convex, tapering from the penultimate whorl to a blunt apex. Whorls  $8\frac{1}{2}$ , flat, first 2 smooth, remainder sculptured with weak, oblique, nearly straight, sub-distant striolae, strongest just below the suture and behind the labrum; suture shallow. Aperture quadrate, rounded at base, dentition irregular, with 4 main processes, which are seldom absent: a short, nearly vertical parietal lamella, scarcely connected with the labrum; a fairly prominent denticle low on labrum; a smaller one on extreme left of base and a small, low tubercle at top of columellar margin; in addition to these, there is frequently a minute denticle just above the lower labral, and very seldom another in centre of base, which has only been observed to occur when all the other dental processes are present. There is no dentition in the young, which have a narrow umbilicus that becomes closed, forming a rima, when the shell attains maturity; the animal is green in colour and arboreal in habit. An average example measures

Long. 9·2, lat. 4·4; apert. alt. (intern.)  $2\cdot 1$ , lat.  $2\cdot 2$ ; last whorl  $4\cdot 8$  mm., the length varying from about  $8\cdot 0$  to  $11\cdot 0$  and breadth from  $4\cdot 2$  to  $4\cdot 9$  mm.

Hab. NATAL. Durban Harbour (type, Craven); frequent about the south coast; Clansthal; Alexandra Junction (Burnup).

<sup>\*</sup> D.O.A., p. 16. † Bull. Amer. Mus. N.H., xl (1919), p. 223.

ZULULAND. Dukuduku Forest (Toppin). CAPE PROVINCE. Port St. John's (Falcon). Type in British Museum.

#### Gulella zuluensis Conn.

1932. Gulella zuluensis Conn., Ann. Natal Mus., vii, p. 81, pl. iv, f. 13. D.F.

Similar in nearly all respects to *natalensis*, from which it differs mainly in dentition, which is confined to three processes only; a strong, incurved, pointed angular lamella; a mid-labral tubercle, corresponding to a shallow, rather broad external depression, and a flat shelf deep-set in the columellar angle. There are 8 nearly flat whorls, sculptured as in *natalensis*, the type measuring

Long. 10.8, lat. 5.0; apert. alt. 2.3, lat. 1.9; last whorl 6.1 mm.

Hab. ZULULAND. Sinkwazi (type, Pennington); St. Lucia and False Bay (Bell Marley).

Type in British Museum.

# Gulella pondoensis sp. n.

(Pl. ii, f. 2.)

Bears close resemblance to *natalensis* in all details except dentition, which in the only two mature examples to hand is regular and 5-fold, a strong angular lamella, 2 distinct labral denticles, lower the longer, with a single external pit; another, short and acute, on left of base and a strong, nearly horizontal, triangular lamella a little more than half-way up the columcila.

Long. 11.5, lat. 5.0; apert. alt. (intern.) 2.1, lat. 1.7; last whorl 5.4 mm.

Hab. CAPE PROVINCE. Port St. John's (Falcon).

Type in British Museum.

The second specimen is smaller,  $9.3 \times 4.3$  mm., and an immature example is narrowly umbilicate.

# Gulella queketti (M. & P.).

Ref. List No. 91.

1896. Ennea queketti M. & P., A.M.N.H., xviii, p. 315, pl. xvi, f. 2. D.F.

Shell large, subcylindriform, nearly smooth, glossy. Sides of spire very slightly convex, summit, 4 whorls, a broad, low cone. Whorls 8, nearly flat, last 4 gradually increasing, first 2 smooth, remainder sculptured with very fine, close, regular, nearly straight, oblique striolae. Aperture quadrate, rounded at base, peristome white, glossy, rather narrowly reflexed, dentition 3-fold: a rather short, incurved lamella on the right of the paries, but quite unconnected with the labrum, a small mid-labral denticle with a shallow external depression, and a low, broad, blunt columellar lamella.

Long. 13.3, lat. 6.8; apert. alt. (intern.) 2.8, lat. 3.1; last whorl 6.4 mm.

An Equeefa specimen is considerably shorter,  $11.2 \times 6.1$  mm.

Hab. NATAL (type, Quekett); Umzinto (Pennington); Isipingo (Penther); Equeefa; Lower Umkomaas; Durban; Port Shepstone (Burnup).

CAPE PROVINCE. Port St. John's (Puzey).

Type in British Museum.

# Gulella triglochis (M. & P.).

Ref. List No. 102.

1903. Ennea triglochis M. & P., A.M.N.H., xii, p. 600, pl. xxxi, f. 11. D.F.

1903. Ennea virgo M. & P., A.M.N.H., xii, p. 600, pl. xxxi, f. 10. D.F.

Similar to queketti in form, gloss, and sculpture, but considerably smaller, while there is a small, flat tubercle to left of the base and the parietal lamella is usually connected with the labrum; the type has slightly convex sides and  $7\frac{1}{2}$  flattish whorls, first  $3\frac{1}{2}$  forming a conical summit, remainder regularly increasing; it measures

Long.  $8\cdot 1$ , lat.  $4\cdot 2$ ; apert. alt.  $1\cdot 8$ , lat.  $1\cdot 8$ ; last whorl  $4\cdot 2$  mm.

Hab. NATAL. Botha's Hill (triglochis, Burnup).

ZULULAND. Kosi Bay; Dukuduku Forest (Toppin); Lower Umfolosi Drift (virgo, Burnup); Melmoth (Miss Hickey); St. Lucia Bay (Bell Marley).

Type in British Museum.

Although the sides in the type are slightly convex they are usually straight and parallel; a specimen from Kosi Bay measures  $8.5 \times 4.2$ , and two from St. Lucia Bay  $11.8 \times 5.7$  and  $9.5 \times 4.9$  mm. respectively.

### GROUP 3. Dentition 3- or 4-fold.

(i, a). More or less strongly striate, fairly small and narrow.

Gulella infans (Crvn.).

(Pl. i, f. 6.)

Ref. List Nos. 53 and 108.

1880. Ennea infans Crvn., P.Z.S., p. 616, pl. lvii, f. 6. D.F.

1893. ,, *collieri* M. & P., A.M.N.H., xi, p. 23, pl. iii, f. 13. *D.F.* 

1895. Ennea wottoni M. & P., A.M.N.H., xvi, p. 479, pl. xviii, f. 6. D.F.

1925. Gulella infans Crvn., Conn., Trans. R. Soc. S. Africa, xii, p. 117. N.

Shell small, rimate, cylindrical, silky, transparent, pale olivaceous. Spire produced, sides usually straight and parallel, but in short examples sometimes slightly convex. Whorls 7–8, little convex, slowly increasing, first 2 smooth, remainder sculptured all over with close, regular, nearly straight and vertical costulae; suture simple. Aperture quadrate, rounded at base, peristome narrowly reflexed, white and glossy, labrum straight and erect in profile, dentition 3-fold: a strong, rather short angular lamella; a short, rather blunt denticle about halfway down the labrum, corresponding to a minute external pit, and an oblique, immersed shelf, rather than fold, at upper angle of columella. A typical example from Pretoria measures

Long. 5.7, lat. 2.7; apert. alt. (intern.) 1.2, lat. 1.2; last whorl 2.8 mm., but another of the same set is only 4.8 mm. long.

Hab. TRANSVAAL. Lydenburg (infans, Craven); Pretoria District (infans and collieri, plentiful); Johannesburg (Gould); Pietersburg (Farquhar); Zoutpansberg (in South African Museum); Warmbaths (small race, Connolly).

NATAL. Mont aux Sources (Falcon).

ZULULAND. Mfongosi (Jones).

CAPE PROVINCE. Grahamstown (wottoni, Farquhar); Middelburg (small race, Connolly); Albany District (Penther).

S. RHODESIA. Matopos (smooth form, per Farquhar).

LORENZO MARQUES. Masiene (smooth form, Lawrence).

All types in British Museum.

As I proved in 1912 that collieri is identical with infans, it only remains to add that I can find no possible means of distinction, except geographically, between Craven's species and wottoni, which agrees in every detail with the typical form of the former; it is useless to give measurements or go into further details, because all are in perfect agreement with one another, in contrast to some of the local races treated hereunder.

Despite its apparently wide distribution, G. infans is usually very constant in form, sculpture, and dentition; the Warmbaths race is unusually narrow for its length, thus approximating to rogersi, and that from Middelburg, C.P., is also narrow, with a broad tubercle, rather than tooth, on labrum. Mfongosi examples are variable in strength of sculpture, and range in size from  $4.0 \times 2.5$  up to  $6.8 \times 2.9$  mm.

In the series from Matopos and Masiene the striation is weaker, sinulus more pronounced, and labral tooth a little nearer the paries than in type, but these slight discrepancies, and still slighter ones in the radula, scarcely justify varietal separation.

In the radula of a Pietersburg specimen the teeth are of the usual aculeate type; formula  $(21+1+21)\times 89$ .

### Gulella tristãoensis Conn.

1922. Gulella tristãoensis Conn., A.M.N.H., x, p. 115. D. 1925. ,, ,, ,, Trans. R. Soc. S. Africa, xii, p. 118,

pl. iv, f. 6. N.F.R.

Very similar to the foregoing, but differing materially in the appearance of the last whorl, which considerably exceeds half, whereas in *infans* it averages about one-half the total length of the shell; the radula, too, gives ground for specific distinction. The type measures

Long. 5·3, lat. 2·3; last whorl 2·8 mm., but typical examples range from 4·6 to 5·4 mm. long, although the last whorl always exceeds half the total length.

A few specimens distributed sparingly among the type series are longer and broader, with the appearance of weaker sculpture and dentition, though these features are really normal, the apparent weakness being due to the superior size of the shells. Two specimens measure  $6.7 \times 2.9$ , last whorl 3.4 and  $6.3 \times 2.6$ , last whorl 3.0 mm.

Hab. LORENZO MARQUES. District north of Macequece (type, Cressy).

S. RHODESIA. Six miles from Penhalonga (Miss Grey). Type in British Museum.

# Gulella rogersi (M. & P.). Ref. List No. 94.

1898. Ennea rogersi M. & P., A.M.N.H., i, p. 26, pl. viii, f. 6. D.F.

A long, cylindrical, straight-sided shell, similar to *infans* in all other details, but far narrower in proportion. A paratype with 8 convex whorls measures Long. 5·3, lat. 1·9; apert. alt. 1·0, lat. 0·8; last whorl 2·3 mm.

Hab. CAPE PROVINCE. Cradock Commonage (Farquhar). Type in British Museum.

The Teafontein locality given in my Ref. List refers to wottoni.

### Gulella candidula (Morel.). Ref. List No. 19.

1889. Ennea candidula Morel., J. de C., xxxvii, p. 12, pl. ii, f. 2. D.F.

1890. Ennea layardi Ancey, Bull. Soc. Mal. Fr., vii, p. 159. D.

Another cylindrical shell, resembling infans in nearly all respects, but much larger, while the labral process is more often a mere tubercle than a denticle. A paratype with  $7\frac{1}{2}$  nearly flat whorls measures

Long. 6.4, lat. 2.75; apert. alt. 1.2, lat. 1.2; last whorl 3.4 mm.

Hab. CAPE PROVINCE. Port Elizabeth, South End (type), and Kragga Kamma, 17 miles west of Port Elizabeth (Crawford); Port Elizabeth (layardi, Layard).

NATAL. Upper Tugela? (Quekett). Type of *candidula* in British Museum.

This species is probably confined to the Port Elizabeth District; I have not been able to verify the Natal reference, while that from Grahamstown, given in my Ref. List, proves to refer to wottoni.

# Gulella hickeyana (M. & P.). Ref. List No. 50.

1901. Ennea hickeyana M. & P., A.M.N.H., viii, p. 317, pl. ii, f. 4. D.F.

The type is a weathered shell apparently sculptured like *infans* and resembling it in dentition, but as long as *candidula* and markedly more obese, containing 7 whorls and measuring  $6.3 \times 3.0$  mm. in length and breadth.

Hab. NATAL. Biggarsberg (Miss Hickey). Type in British Museum.

### Gulella praelonga Conn.

1922. Gulella praelonga Conn., A.M.N.H., x., p. 115. D.

1925. ,, ,, ,, Trans. R. Soc. S. Africa, xii, p. 117, pl. iv, f. 5. N.F.

Yet another silky, cylindrical shell, with nearly parallel sides and  $7\frac{1}{2}$  flattish whorls, striate rather than costulate, the sculpture being just visible without a lens; dentition as in *infans*, but the processes are not stronger in proportion to the increased size of shell.

Long. 8.8, lat. 3.5; apert. alt. 2.0, lat. 2.0; last whorl 4.1 mm.

Hab. LORENZO MARQUES. Mount Vengo (Cressy).

Type in British Museum.

The narrow elongate form calls to mind the Mascarene genus Gonidomus Swainson, but differs from it, as well as from the Kenyan Gibbulina expatriata Preston, in the presence of a labral tooth. The Albany Museum contains a single specimen from Hopevale, Comadagga, C.P., which much resembles it, but has much stronger dentition; I have also collected a somewhat similar shell, but with far weaker dentition, at Pienaars Poort, Pretoria District, facts which suggest the possibility that all these scattered forms may be but individual giants of a smaller species.

(i, b) Dentition normally 4-fold, but basal process sometimes lacking.

# Gulella johannesburgensis (M. & P.).

Ref. List No. 58.

1907. Ennea johannesburgensis M. & P., A.M.N.H., xix, p. 95, pl. vi, f. 2. D.F.

1932. Gulella johannesburgensis M. & P., Conn., Ann. Natal Mus., vii, p. 71, pl. iv, f. 3-5. D.F.

This widely diffused species is distinguishable from infans mainly by the presence of a small, but prominent columellar lamella instead of a mere shelf and, normally, of a basal denticle, which is, however, sometimes very weak or absent; a rather strongly sculptured but otherwise typical example from Standers Kop is rather small, cylindrical, with silky sheen. Spire produced, sides straight and parallel, summit bluntly rounded. Whorls 8, rather flat, first  $2\frac{1}{2}$  smooth, remainder sculptured with strong, close, regular, nearly straight and vertical costulae. Aperture quadrate, rounded at base, dentition normally 4-fold: a strong oblique angular lamella; a long narrow denticle half-way down the labrum, with a well-defined external pit; a small one on left centre of base and a small, bluntly rounded columellar lamella.

Long. 6.0, lat. 2.0; apert. alt. 1.0, lat. 1.0; last whorl 2.75 mm.

Hab. TRANSVAAL. Johannesburg (type, Johnson; McBean); Potchefstroom (Miss Cachet); Standerton (Connolly); Pepiti Falls (Harries).

ORANGE FREE STATE. Bloemfontein (Connolly).

NATAL. Weenen District (Burnup); Mkolombe (Thomasset).

ZULULAND. Mfongosi (Jones).

Type in British Museum.

While showing considerable variation in size, though not in form, the sculpture is so diverse that extremes in this respect may possibly represent different species. The type,  $6\times 2$  mm. in size, has rather weaker striation than that described above, being almost smooth on front of body whorl, and the Bloemfontein race,  $5\times 2$  mm., is similar; in part of a large series from Standers Kop both labral and basal denticles are very weak, and the striae, weak on the upper whorls, are absent from the last two except for short lines immediately below the suture, finally, the race at Pepiti Falls is almost void of striation except just below the sutures, the base of labral denticle is broader, columellar lamella less prominent, and basal process a mere tubercle, situate low down the columella.

## Gulella drakensbergensis (M. & P.). Ref. List No. 39.

1893. Ennea drakensbergensis M. & P., A.M.N.H., xii, p. 107, pl. iii, f. 9. D.F.

Founded on a single specimen, which is small, widely cylindrical, with a bluntly rounded summit of  $2\frac{1}{2}$  whorls. There are  $6\frac{1}{2}$  whorls, not very convex, last 4 almost equal, first 2 smooth, remainder sculptured all over with strong, rather coarse, regular, straight, slightly oblique costulae; suture simple. Aperture quadrate, with prominent sinus, dentition exactly as in the last species, except that the labral tooth is bluntly triangular, and thus broader at the base than in the other.

Long. 4.5, lat. 2.0; last whorl 2.75 mm.

Hab. NATAL. Pietermaritzburg (type, fide M. & P.). ZULULAND. Mfongosi (Jones).

Type in British Museum.

The type is remarkable for its strong, coarse sculpture, but the generality of examples from Maritzburg and Zululand are very much smoother, their striation only visible under a lens, and in some cases practically absent except in the suture. The species is extremely near allied to *johannesburgensis*, of which, if conspecific, it has priority.

# Gulella miniata (Krs.). Ref. List No. 85 (pars).

1848. Pupa pfeifferi, var. miniata Krs., Südafr. Moll., p. 79. D. 1932. Gulella miniata Krs., Conn., Ann. Natal Mus., vii, p. 72, pl. iv, f. 1. D.F.

Extremely near to the well-sculptured form of *johannesburgensis* described above, but in the latter the labral denticle is equally narrow from base to apex, whereas in *miniata* it arises from a broadish base and tapers to a point. The type contains 8 whorls, and measures

Long. 5·3, lat. 2·2; apert. alt. 1·3, lat. 1·1; last whorl 3·0 mm.; it differs slightly from all others of the original lot in that the labral tooth has a broader, almost bicuspid edge, the lower cusp a little the longer.

Hab. BECHUANALAND. Mt. Mohapani (Mopani, S.W. of Palapwe, Wahlberg).

Type in Stuttgart Museum.

# Gulella rhodesiana (Conn.).

Ref. List No. 93.

1912. Ennea rhodesiana Conn., Ann. S.A. Mus., xi, p. 85, pl. ii, f. 2. D.F.

A small, shortly cylindrical, rather glossy shell with rounded summit. Whorls 5, convex, first two smooth, remainder sculptured with regular, nearly straight, oblique striae. Aperture subquadrate, dentition 4-fold: a strong oblique angular lamella; a well-defined labral tooth; a small denticle on left centre of base and a thick, blunt columellar lamella.

Long. 3.7, lat. 1.8; apert. alt. 0.9, lat. 1.0; last whorl 2.0 mm.

Hab. S. RHODESIA. Victoria Falls (type, Connolly).

TRANSVAAL. Blaauwberg, 90 miles north of Pietersburg (M. Ziervogel).

Type in South African Museum.

The species inhabits both banks of the Zambesi at the Victoria Falls; the labral process varies in strength from a pointed denticle to a squarer tooth, the lower edge longer, with almost the appearance of bifidity.

(i, c) Large, strongly sculptured shells with 3- to 5-fold dentition.

## Gulella crassilabris (Crvn.).

#### Ref. List No. 28.

1880. Ennea crassilabris Crvn., P.Z.S., p. 616, pl. lvii, f. 5. D.F. euschemon M. & P., A.M.N.H., iv, p. 487, pl. viii, 1909. f. 5. D.F.

1922. Gulella crassilabris Crvn., Conn., Proc. Mal. Soc., xv, p. 72. N.

1932. Gulella crassilabris Crvn., Conn., Ann. Natal Mus., vii, p. 82. N.F.

A large cylindrical shell with sculpture and 3-fold dentition usually as in infans, the columellar process, as in that species, being an obscure oblique shelf, but there is occasionally an extra process in the form of a slight swelling on left of base; a typical example from Belfast with  $8\frac{1}{2}$  nearly flat whorls measures

Long. 10.8, lat. 4.4; apert. alt. 1.9, lat. 1.9; last whorl 4.9 mm.

Hab. TRANSVAAL. Lydenburg (type, Craven); Pietpotgietersrust; Pruizen (euschemon, Connolly); Belfast (per Hewitt); Hartebeeste Poort, Crocodile River (per Puzey).

Both types in British Museum.

The shell varies in size from  $8.0 \times 4.3$  with 7 whorls, to  $13.6 \times 4.7$ mm. with 9 whorls.

#### Gulella sibasana Conn.

1922. Gulella sibasana Conn., Proc. Mal. Soc., xv, p. 70, pl. ii, f. 5. D.F.

Similar to foregoing in most important details, but usually with slightly convex sides. 9 whorls, almost flat, sculptured as above, aperture subquadrate, dental processes consisting of a strong angular lamella; a rather small tooth, single in the type, but occasionally with a smaller denticle above it, half-way up the labrum, with a small external cavity; a very small tubercle on extreme left of base and a hardly noticeable columellar shelf. The type measures

Long. 9.8, lat. 5.0; apert. alt. 3.2, lat. 1.8; last whorl 4.5 mm., but the largest

example examined is  $12.5 \times 6.3$  mm. in length and breadth.

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Hab. TRANSVAAL. Luvimbi, Sibasa (type, Junod); Pepiti Falls (Harries).

Type in Kimberley Museum.

Note.—G. distincta (M. & P.) falls naturally within this group, but owing to the presence of a sinular denticle must be relegated to Group 6.

(ii) Practically smooth, smallish shells with 3- to 4-fold dentition.

### Gulella perspicua (M. & P.). Ref. List No. 83.

1893. Ennea perspicua M. & P., A.M.N.H., xi, p. 23, pl. iii, f. 12. D.F.

A small, smooth shell with straight parallel sides, identical with infans except for total lack of sculpture and the occasional presence of a swelling, scarcely a tubercle, on left of base. A Barberton example with  $7\frac{1}{2}$  whorls measures

Long. 4.8, lat. 2.4; apert. alt. 0.8, lat. 0.8; last whorl 2.5 mm.

Hab. TRANSVAAL. Middelburg (type, Crawford); Barberton (Déglon).

Type in British Museum.

# Gulella kraussi (Pfr.).

Ref. List No. 61.

1855. Ennea kraussi Pfr., Mal. Blätt., ii, p. 174. D.

1898. ,, sejuncta Stur., S.A. Moll., p. 24, pl. i, f. 10-12. D.F.

1925. Gulella kraussi Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 120. N.

Shell of fair size, usually cylindrical, smooth and glossy. Spire produced, sides parallel, usually straight, summit rounded. Whorls 7, nearly flat, sculptured with almost invisible, straight, slightly oblique, irregular growth striolae of negligible character. Aperture as in group, with perfectly simple 4-fold dentition: a strong short angular lamella; a strong triangular tooth half-way down labrum, with a large external pit; a sharp denticle on left of base and a strong ridge-like triangular columellar lamella; a typical example from Durban measures

Long. 7.0, lat. 3.0; apert. alt. (intern.) 1.1, lat. 1.1; last whorl 3.7 mm., another example being only 6 mm. in length.

Hab. NATAL. Port Natal (type, Plant); Durban (sejuncta, Penther); generally distributed over Southern Natal.

LORENZO MARQUES. Delagoa Bay (ex coll. Cuming in British Museum).

Type of kraussi in Stettin, sejuncta in Vienna Museum.

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### Gulella subkraussi Conn.

1932. Gulella subkraussi Conn., Ann. Natal Mus., vii, p. 87, pl. iv, f. 12. D.F.

Similar to the foregoing in nearly all respects, but sculptured with close, regular striae, faint except for a short distance below the sutures and near the outer lip, while the labral denticle is narrow, of uniform thickness throughout, without basal broadening as in kraussi. The type contains 8 whorls and measures

Long. 7.0, lat. 3.0; apert. alt. 1.5, lat. 1.4; last whorl 3.1 mm.

Hab. NATAL. Vryheid (type); Paulpietersburg (Puzey). Type in British Museum.

### Gulella juxtidens (M. & P.).

Ref. List No. 59.

1899. Ennea juxtidens M. & P., A.M.N.H., iv, p. 195, pl. iii, f. 2. D.F.

1914. Ennea juxtidens M. & P., Bnp., Ann. Natal Mus., iii, p. 72, pl. v, f. 57–59. N.F.

Far smaller than *subkraussi*, quite smooth except for short striae immediately below the sutures; dentition 4-fold, the labral denticle being sharp and simple. The type contains  $6\frac{1}{2}$  whorls and measures  $4\cdot3\times1\cdot7$  mm. in length and breadth.

Hab. NATAL. Van Reenen (type, Mrs. Quekett); Mont aux Sources (Puzey).

Type in British Museum.

### Gulella nepia Conn.

1925. Gulella nepia Conn., Trans. R. Soc. S. Africa, xii, p. 121, pl. iv, f. 7. D.F.

Shell small, cylindrical, rimate, smooth and glossy. Spire produced, sides straight and parallel, apex obtusely angulate. Whorls 6, nearly flat, gradually increasing, devoid of sculpture save for a few distant, irregular, oblique growth lines; suture simple, shallow. Aperture subquadrate, peristome reflexed, dentition 3-fold: a protruding, not far entering, angular lamella, a small blunt tubercle, without external depression, slightly within the margin half-way up the labrum, and an exactly similar tubercle half-way up the columella.

Long. 5·3, lat. 2·2; apert. alt. 1·3, lat. 1·1; last whorl 2·75 mm.

Hab. LORENZO MARQUES. Macequece District (type, Cressy). S. RHODESIA. Salisbury (Sir G. Marshall).

Type in British Museum.

One of the very small group in which the principal columellar process is situate half-way up the columella, instead of at its upper angle, and thereby easily recognisable.

The single example from Salisbury differs considerably from type in having very strong vertical puckers extending from the suture nearly half-way down the last  $3\frac{1}{2}$  whorls, while there is but a mere vestige of the tubercle on columellar margin; it may well prove to be specifically distinct.

The typical form is also known from Northern Rhodesia.

# Gulella digitalis sp. n. (Pl. i, f. 2.)

Shell rather large, narrow cylindrical, umbilicate, smooth, glossy, transparent, pale olivaceous. Spire much produced, sides straight and parallel, summit, 3 whorls, rounded. Whorls 8½, nearly flat, last 5 nearly equal, first 2½ quite smooth, remainder sculptured with weak irregular growth striolae, so faint as hardly to be visible except on the last whorl, including its front; suture shallow. Aperture short, quadrate, rounded at base, peristome narrowly expanded, dentition 4-fold: a short, nearly vertical angular lamella, scarcely connected with the labrum; a very short, broad-based, mid-labral denticle, with horizontal external depression; a minute tubercle on left of base and a practically negligible low, blunt, deep-set, columellar lamella. Umbilicus round and very narrow.

Long. 9.4, lat. 3.0; apert. alt. 1.7, lat. 1.3; last whorl 4.1 mm.

Hab. NATAL. Stella Bush, Durban (Puzey).

Type in British Museum.

There is really no other species to which this conspicuous form can be profitably compared. The extreme weakness of the columellar lamella precludes its acceptance as a monstrosity of *kraussi* or its smooth allies, while the basal tubercle and lack of sculpture separate it from *praelonga* and others of the *infans* group; in general aspect it somewhat resembles the Kenyan *expatriata* and *rectangularis* Preston, but does not stand close comparison with either.

# Gulella magnolia (Conn.). Ref. List No. 64.

1912. Ennea magnolia Conn., Ann. S.A. Mus., xi, p. 78, pl. ii, f. 1. D.F.

Shell very small, cylindriform, subrimate, smooth and glossy. Spire narrow, with normally straight and parallel sides, but sometimes crooked, or swollen toward the apex. Whorls 6, flattish, practically devoid of sculpture. Aperture subquadrate, peristome slightly thickened and reflexed, dentition 3-fold: a short acute angular lamella; an inconspicuous process, little more than a protuberance caused by slight straightening, half-way down, of the labrum, which forms an obtuse angle at this point, and a long, low, hardly noticeable obtuse angled shelf on columella.

Long. 4·75, lat. 1·4; apert. alt. 0·95, lat. 0·85; last whorl 1·8 mm., but the whorls vary in number from 6 to  $6\frac{1}{2}$  and the length from 3·9 to 4·8 mm.

Hab. S. RHODESIA. Rain Forest, Victoria Falls (Connolly). Type in British Museum.

(ii, a) Minutiae.

### Gulella pentheri (Stur.).

Ref. List No. 79.

1898. Ennea pentheri Stur., S.A. Moll., p. 30, pl. ii, f. 32–33. D.F. 1926. Gulella ,, ,, Bnp., Ann. Natal Mus., v, p. 357, pl. xxi, f. 6–11. D.F.

Shell very small, cylindrical, smooth and glossy. Sides straight and nearly parallel, occasionally tapering slightly upwards, summit, 2 whorls, bluntly rounded. Whorls 6, not very convex, practically void of sculpture, suture shallow, strongly margined. Aperture quadrate, dentition 3-fold: a short erect angular lamella; a blunt denticle half-way down the labrum and a triangular columellar lamella.

Long. 3·1, lat. 1·1; last whorl, 1·4 mm., but length varies from 2·17 to 3·33 mm.

Hab. NATAL. Isipingo (type, Penther); widely distributed over the southern districts.

CAPE PROVINCE. Bushman R., west of Port Alfred (Hewitt); East London (Kincaid); Kowie (Farquhar).

Type in Vienna Museum.

Burnup states that the smallest known forms come from the coast and the largest from higher latitudes inland, though there may be nothing of lasting value in the suggestion; no apertural armature has been observed in young shells.

### var. ischyrion Bnp.

1926. Gulella pentheri Stur., var. ischyrion Bnp., Ann. Natal Mus., v, p. 361, pl. xxi, f. 12–13. D.F.

Shell like that of *pentheri*, but differing in the possession of a minute denticle on left of base; there are 6 whorls.

Long. 2.5, lat. 0.87; last whorl 1.3 mm.

Hab. CAPE PROVINCE. Kowie East (type); East London; Blaauwkrantz, Grahamstown; Trappes Valley, Bathurst (Kincaid and others); Kowie (Farquhar).

Type in British Museum.

Burnup mentions the occasional presence in this variety, as well as the typical form, of a slight swelling on the columellar lip, too insignificant to be of importance; the average size is rather less than type, and average width slightly greater.

### var. kowieensis Bnp.

1926. Gulella pentheri Stur., var. kowieensis Bnp., Ann. Natal Mus., v, p. 362, pl. xxi, f. 14-16. D.F.

Differs from type in much smaller size, though relatively rather wider; fewer whorls, forward bend of labrum more abrupt, presence of a denticle on left of base, and the labral tooth, instead of being round and single, consists of two little cones arising from a low base, the lower being the longer and more deep-set. Separable from ischyrion by much smaller size, fewer whorls, the double labral tooth and position of basal denticle, which is slightly more to the left than in the other variety. Whorls 5 to  $5\frac{1}{2}$ .

Long. 1.8, lat. 0.65; last whorl 0.8 mm.

Hab. CAPE PROVINCE. Kowie (Kincaid).

Type in British Museum.

Perhaps the smallest of yet known South African Gulellae, the only other to be compared in this respect being columnella, var. vitreola, which, though occasionally shorter, is invariably wider than the present form.

## Gulella inhluzaniensis (Bnp.).

1914. Ennea inhluzaniensis Bnp., Ann. Natal Mus., iii, p. 71, pl. v, f. 53-55. D.F.

Shell very small, cylindriform, smooth and glossy. Sides of spire straight, summit,  $2\frac{1}{2}$  whorls, bluntly rounded. Whorls  $6\frac{1}{2}$ , nearly flat, last 4 with fine, slightly oblique striolae just below the sutures, occasionally extending further, and stronger on the last half-whorl, which they cross to the base; suture well defined. Aperture upright-oblong, dentition 4-fold: a short erect angular lamella; a rather long, narrow mid-labral denticle; an immersed slightly rounded shelf at upper angle of columella, and a practically negligible swelling about the centre of the columellar margin.

Long. 3.25, lat. 1.7; last whorl 1.75 mm.

Hab. NATAL. Inhluzani Hill, Dargle (Burnup).

Type in British Museum.

Easily distinguishable from *pentheri* by the presence of infrasutural striation.

# Gulella perspicuaeformis (Stur.). Ref. List No. 84.

1898. Ennea perspicuaeformis Stur., S.A. Moll., p. 17, pl. i, f. 2.

D.F.

1925. Gulella perspicuaeformis Stur., Conn., Trans. R. Soc. S. Africa, xii, p. 119. N.

Shell minute, cylindriform, smooth and glossy. Sides of spire practically straight, summit, 3 whorls, bluntly rounded. Whorls 6, nearly flat, smooth but

for a few transverse striolae behind the labrum. Aperture quadrate, rounded at base, dentition 3-fold: a short vertical angular lamella; a small mid-labral denticle and a weak immersed columellar fold.

Long. 2.6, lat. 1.3; last whorl 1.27 mm.

Hab. LORENZO MARQUES. Delagoa Bay (Penther). Type in Vienna Museum.

Gulella bowkerae (M. & P.).

Ref. List No. 14.

1892. Ennea bowkerae M. & P., A.M.N.H., ix, p. 92, pl. vi, f. 9. D.F.

Shell very small, cylindrical, smooth and glossy. Sides straight and parallel or very slightly convex, summit, 3 whorls, rounded. Whorls 7, nearly flat, last 4 increasing very slowly, first 2 smooth, remainder sculptured with extremely faint, sometimes almost imperceptible, oblique growth striolae; suture shallow. Aperture nearly semicircular, dentition 4-fold: a long, very oblique, crescentic angular lamella; a strong acute or squarish mid-labral denticle, with a small external pit; a broad, low, ridge-like tooth on left centre of base and a large, round deep-set columellar lamella.

Long. 3.5, lat. 1.4; last whorl 1.8 mm.

Hab. CAPE PROVINCE. East London (type, Miss Bowker); Kowie (Farquhar); Emagusheni (Puzey); Tonti Forest, Pondoland (Falcon).

Type in British Museum.

The short wide aperture with huge oblique angular lamella and long flat basal tooth render this little species easily recognisable.

GROUP 4.

Section Gulella s.s.

(Reference as for genus.)

Type Pupa menkeana Pfr.

Dental processes 5, angular lamella, 2 more or less distinct labral and 1 basal tooth, and a large, usually immersed columellar lamella.

(i) With strong sculpture.

Gulella menkeana (Pfr.).

(Pl. i, f. 15.)

Ref. List No. 68.

1853. Pupa menkeana Pfr., Mon. Hel., iii, p. 551. D.

Shell comparatively large, rimate, subcylindrical, silky. Spire produced, very slightly broader at the 6th than at the later whorls, sides nearly straight, summit,

4 whorls, conical. Whorls 8, nearly flat, first two smooth, remainder sculptured with strong, close, regular, nearly straight, oblique costulae; suture shallow. Aperture short and wide, peristome slightly expanded, labrum erect in profile, dentition 5-fold: a strong, oblique angular lamella; 2 labral denticles, the lower the longer and arising nearer the surface than the upper, springing from a single base which corresponds to a deep external pit; a small denticle, also corresponding to an external pit, on left centre of base, and a horizontal lamella on a triangular base near the top of the columella. The type appears to be lost, and the description and figure here given are from a paratype from the Albers collection, ex Shuttleworth, in the Berlin Museum.

Long. 13.0, lat. 6.3; apert. alt. 2.7, lat. (intern.) 3.0; last whorl 6.3 mm.

A second paratype with broken apex is perfectly straight-sided and 6.5 mm. wide; the type was said to measure 11 × 5 mm.

Hab. NATAL. Port Natal (coll. Menke).

## Gulella albersi (Pfr.).

Ref. List No. 8.

1854. Pupa albersi Pfr., P.Z.S., p. 295. D.

1903. Ennea ,, M. & P., A.M.N.H., xii, p. 596. D.F.

Merely a large edition of menkeana, with which it is probably conspecific. The type is rather barrel-shaped, but the other two shells in the type set are more evenly evlindrical; all are about the same size, measuring

Long. 14.8, lat. 6.3; apert. alt. 3.3, lat. 3.0; last whorl 7.8 mm.

Hab. NATAL. Port Natal (type, Strangier); Port Shepstone, both sides of R. Umzimkulu (Burnup); Scottburgh; Port Edward (Falcon).

Type in British Museum.

Some of the Port Shepstone examples measure  $15.2 \times 7.2$ ,  $15.5 \times 7.5$ ,  $16.6 \times 7.1$ , and  $16.9 \times 7.8$  mm.

# Gulella calopasa (M. & P.).

Ref. List No. 18.

1903. Ennea calopasa M. & P., A.M.N.H., xii, p. 596. D.F.

Differs from albersi in smaller size and the labral teeth, of which in that species the upper is the smaller and the lower arises nearer the peristome, while in calopasa the lower is the smaller and the upper arises nearer the peristome.

Long. 13.4, lat. 6.0; apert. alt. 3.3, lat. 2.3; last whorl 7.1 mm.

Hab. NATAL. Port Shepstone, both sides of R. Umzimkulu (type, Burnup); Port Edward (Falcon).

Type in British Museum.

# Gulella consobrina (Ancey).

Ref. List No. 26.

1892. Ennea consobrina Ancey, Brit. Nat., p. 125. D.

1914. ,, ,, Bnp., Ann. Natal Mus., iii, p. 50, pl. iv, f. 36. D.F.

1926. Gulella consobrina Ancey, Bnp., Ann. Natal Mus., v, p. 386, pl. xv, f. 31. N.F.

Shell of fair size, cylindrical, rimate, silky, with nearly parallel sides and very obtuse summit. Whorls 8, first 2 bearing extremely close and fine microscopic transverse striolae, remainder sculptured all over, except on paries, with close, regular, oblique costulae; suture subcrenulate, rather shallow. Aperture subquadrate, narrowly rounded at base, peristome reflexed, dentition 5-fold: a prominent angular lamella; a long mound, corresponding to a shorter external depression, extending nearly the entire length of labrum, bearing 2 distinct denticles, with a slight protuberance above them; a small acute denticle on left of base and a prominent triangular fold, strongly ridged along upper surface, at upper angle of columella.

Long. (type), 7.9, lat. 3.3; apert. alt. 1.7, lat. 2.2; last whorl 4.1 mm.

Hab. CAPE PROVINCE. Albany (type, Miss Glanville); Martindale (Farquhar); East London (Rattray, Kincaid).

NATAL. Southport (Puzey).

Type in coll. Tomlin.

#### Gulella orientalis Conn.

1929. Gulella orientalis Conn., Ann. Natal Mus., vi, p. 222, pl. xiv, f. 3. D.F.

1932. Gulella orientalis Conn., Ann. Natal Mus., vii, p. 87, pl. iv, f. 14. N.F.

A silky, cylindriform shell with parallel sides, 7 nearly flat whorls, the later sculptured with strong, close, regular, oblique costulae; quadrate aperture with 5-fold dentition, the labral process consisting of a large tooth with two cusps, of which the lower is twice as long as the upper. The type measures

Long. 7·1, lat. 3·4; apert. alt. 1·5, lat. 1·3; last whorl 3·6 mm.

Hab. ZULULAND. Mfongosi District (type, Jones).

NATAL. Wyebank (Puzey); Sand Spruit, Weenen (Burnup).

Type in South African Museum.

Very closely allied to consobrina, but with slightly coarser sculpture, while the labral teeth are unequal in length, instead of being almost equal; in a large series from Weenen the small upper labral denticle, though nearly always present, is sometimes represented by a mere swelling and, in rare instances, absent altogether.

# Gulella framesi Bnp.

1926. Gulella framesi Bnp., Ann. Natal Mus., v. p. 387, pl. xxi, f. 32-33. D.F.

A rather large cylindriform shell with 74-8 whorls, similar to consobrina in form, sculpture, and general dentition, but the labral process is a long base bearing 2 very distinct, well-defined denticles, the lower the longer, the upper so high as to narrow the sinulus, while the columellar lamella is rounded, with a deep well on the upper surface of its base, whereas in consobrina the labral base bears 2 small lower denticles and a slight angulation, rather than cusp, at its upper end, and the columellar lamella is pointed, its upper surface strongly ridged. A paratype with 8 whorls

Long. 7.45, lat. 3.2; apert. alt. 1.0, lat. 1.1; last whorl 3.5 mm.

Hab. CAPE PROVINCE. Hankey, Gamtoos Valley (type, Rogers); Alicedale (small race, Cruden); Grahamstown (Farquhar).

Type in British Museum.

The last two series are smaller and comparatively a little narrower than type, the labral denticles much smaller, with the lower closer to the upper, and the well on the rounded columellar lamella is less conspicuous, but they scarcely merit varietal distinction; an average example measures

Long. 6.9, lat. 2.5; apert. alt. 0.9, lat. 0.9; last whorl 3.5 mm.

## Gulella subframesi Conn.

1929. Gulella subframesi Conn., Ann. Natal Mus., vi, p. 222, pl. xiv, f. 4. D.F.

A small, rather solid, rugose, cylindrical shell with straight, parallel sides and bluntly rounded summit. Whorls 6, moderately convex, last 4 almost equal, sculptured with strong, close, regular, nearly vertical costulae. Aperture quadrate, dentition 5-fold, the labral process being a small double tooth, of which the lower prong is larger, half-way down the lip.

Long. 5·0, lat. 2·2; apert. alt. 1·0, lat. 1·0; last whorl  $2\cdot5$  mm.

Hab. ZULULAND. Mfongosi District (Jones).

Type in South African Museum.

A model in miniature of framesi Bnp., but with more convex whorls.

# Gulella delicatula (Pfr.).

Ref. List Nos. 35, 37, 42, 75.

1856. Ennea delicatula Pfr., Mal. Blätt., iii, p. 259. D.

nonotiensis M. & P., A.M.N.H., xiv, p. 95, pl. i, 1894. f. 15. D.F.

1898. Ennea dokimasta M. & P., A.M.N.H., i, p. 27, pl. viii, f. 7. D.F.

1898. Ennea docimasta M. & P., Proc. Mal. Soc., iii, p. 167 (Emend. Nom.).

1909. Ennea eshowensis M. & P., A.M.N.H., iv, p. 487, pl. viii, f. 4. D.F.

1926. Gulella delicatula Pfr. (=nonotiensis, docimasta, and eshowensis M. & P.), Bnp., Ann. Natal Mus., v, p. 367, pl. xxi, f. 19-23. D.F.

Shell small, cylindrical, silky. Sides straight and parallel or slightly convex, summit,  $3\frac{1}{2}$  whorls, obtusely rounded. Whorls  $7\frac{1}{2}$ , nearly flat, first 2 smooth, remainder sculptured with close, regular, nearly straight, oblique striae, finer and closer behind the lips of aperture; suture shallow, with false appearance of beading. Aperture quadrate, rounded at base, dentition 5-fold: a strong, nearly vertical angular lamella; a low labral base with narrow external pit, bearing at each extremity a small denticle, lower the stronger, upper sometimes almost deficient; a small denticle on left of base and a squarish or bluntly pointed columellar lamella.

Long. 5.9, lat. 2.9; apert. alt. (intern.) 0.9, lat. 1.1; last whorl 3.2 mm.; the number of whorls varies from  $6\frac{1}{2}$  to 8 and size from  $4.9 \times 2.6$  to  $6.85 \times 3.05$  mm.

Hab. NATAL (docimasta, McKen); Port Natal (delicatula, Plant); Nonoti, Stanger (nonotiensis); Krantzkop; Tongaat; Table Mountain (Burnup); Sinkwazi (Pennington); Karkloof (Taynton).

ZULULAND. Eshowe (eshowensis, Lady Saunders); Melmoth (Miss Hickey).

Probable type of delicatula and types of nonotiensis, docimasta, and eshowensis in British Museum.

## Gulella aperostoma (M. & P.). Ref. List No. 10.

1892. Ennea aperostoma M. & P., A.M.N.H., ix, p. 93, pl. vi, f. 10. D.F.

A rather broad, cylindrical shell with 7 flattish whorls, first 3 smooth, remainder covered with extremely close, fine, regular, slightly curved and oblique striolae; aperture wide, quadrate, narrowing and rounded at base; dentition as in group, the 2 labral teeth practically equal in size, comparatively distant, marked by a long external pit, narrower in the middle; columellar lamella horizontal, little inset.

Long. 8·1, lat. 3·8; apert. alt. (intern.) 1·4, lat. 1·7; last whorl 4·7 mm.

Hab. NATAL (type, Layard).

CAPE PROVINCE. Great Fish River Point, near Port Alfred (J. B. L. Smith).

Type in British Museum.

Distinguished by its open mouth and delicate sculpture.

## Gulella premnodes (Stur.). Ref. List No. 89.

1902. Ennea premnodes Stur., Ann. Hofmus. Wien, xvi, p. 69,

f. 5. D.F. 1914. Ennea premnodes Stur., Bnp., Ann. Natal Mus., iii, p. 73, pl. v. f. 56. D.F.

Shell very small, narrow, cylindrical, nearly smooth. Spire elongate, sides straight and practically parallel, summit rounded. Whorls 7-8, rather flat, slowly increasing, first 2½ smooth, remainder sculptured for a short distance below the suture with regular, rather coarse and distant costae, which only extend further down along the 4th, and last half of body whorl; suture well defined. Aperture quadrate, peristome expanded and reflexed, with a kind of tubercle at extreme top of outer margin of sinulus, which causes it to project sharply from the suture; dentition 4- to 5-fold: a short, strong angular lamella; a broad, almost blunt tooth, corresponding to a small external pit, half-way down the labrum, the lower side longer than the upper, each bearing occasionally a minute cusp, imparting a 5-fold appearance to the dentition; a denticle on left centre of base and a blunt inset columellar lamella; a paratype in my collection measures

Long. 5.5, lat. 1.7; apert. 0.8; last whorl 2.2 mm.; while another paratype is only 5.0 mm. in length, and Burnup's specimen is said to be, roughly,  $5.9 \times 2.2$  mm.

Hab. CAPE PROVINCE. Albany District (type, Penther); Kowie West (Kincaid).

Type in Vienna Museum.

While very nearly allied to caryatis, the present species appears separable by its larger size and squarer, comparatively narrower labral tooth, on which the minute cusps, when apparent, are far weaker; it ought, perhaps, to be placed in the 4-toothed group, but that its general aspect is so much that of the mid-Cape species hereabouts treated.

# Gulella pfeifferi (Küst.). (Pl. i, f. 10.) Ref. List No. 85.

1841. Pupa pfeifferi Krs., Küst., Conch. Cab., p. 87, pl. xii, f. 17-19. D.F.

1932. Gulella pfeifferi Küst., Conn., Ann. Natal Mus., vii, p. 72, pl. iv, f. 2. N.F.

Shell small, usually cylindriform, silky. Sides parallel, straight or very slightly convex, summit, 3½ whorls, obtusely conoid. Whorls 8½, nearly flat, last 5 nearly equal, first 21/2 smooth, remainder sculptured with close, regular, nearly straight, oblique costulae; suture well defined. Aperture quadrate, sinulus prominent, peristome expanded, dentition roughly 5-fold: a strong, nearly straight and vertical angular lamella; a large quadrate base, lower side longer, corresponding to a single external pit, bearing at each extremity a small cusp; a narrow denticle

just to left centre of base, and a bluntly rounded columellar lamella with a well at its base; an average example measures

Long. 5·6, lat. 2·2; apert. alt. (intern.) 0·8, lat. 0·8; last whorl 2·4 mm., the longest and shortest specimens examined being 6·3 and 4·3 mm. in length.

Hab. CAPE PROVINCE. Potteberg; Swellendam (Krauss); Keurboom R. bush, 25 miles east of Knysna (Barnard).

Type in Stuttgart Museum.

A large member of the *minuta* group, but peculiar in that the labral tooth only becomes bifurcate near its extreme point, so that it was originally described as single; this feature is fairly constant in many specimens, as is also the width, irrespective of length, of the shell.

As the paratype I figured in 1932 is not quite normal and its exact representation is important in view of its close relationship to *minuta*, I now give a figure of the type itself; its dimensions are

Alt. 5.2, lat. 2.1; last whorl 2.4 mm.

The Keurboom shells differ from type in the labral tooth having a longer base and the cusps at each end shorter and wider apart, but I hesitate to separate them.

## Gulella minuta (Morel.).

Ref. List Nos. 22, 30, 31, 38, 70, 100, 104.

1889. Ennea pusilla Morel., J. de C., xxxvii, p. 13, pl. ii, f. 3. D.F.

1889. Ennea minuta (= pusilla Morel., 1889, non 1881) Morel., ibid., p. 200. N.

1892. Ennea the lodonta M. & P., A.M.N.H., ix, p. 85, pl. vi, f. 4. D.F.

1892. Ennea dolichoskia M. & P., A.M.N.H., ix, p. 86, pl. vi, f. 6. D.F.

1893. Ennea vanstaadensis M. & P., A.M.N.H., xii, p. 110, pl. iii, f. 17. D.F.

1898. Ennea ambigua Stur. (= pusilla Morel., 1889), S.A. Moll., p. 29. N.

1898. Ennea cionis M. & P., A.M.N.H., i, p. 25, pl. viii, f. 4. D.F.

1898. Ennea crawfordi M. & P., A.M.N.H., i, p. 26, pl. viii, f. 5. D.F.

1909. Ennea crispula M. & P., A.M.N.H., iv, p. 486, pl. vii, f. 3. D.F.

1914. Ennea thelodonta M. & P., Bnp., Ann. Natal Mus., iii, p. 51, pl. iv, f. 37. N.F.

1932. Gulella minuta Morel. (=thelodonta, dolichoskia, vanstaadensis, cionis, crawfordi, and crispula M. & P.), Conn., Ann. Natal Mus., vii, p. 69. N.

Shell very small, cylindriform, silky, with straight-sided spire; 6 flattish whorls, last 4 sculptured with strong oblique striae, fainter on front of body whorl. Dentition as in group, labral process usually bifid, but upper cusp frequently absent in a series from same locality, which led to the differentiation of crawfordi M. & P.

The species is fairly constant in breadth, 1.35 to 2.0 mm., but varies in length from 2.3 to 5.05 mm.

Although abundant in the district of Port Elizabeth, it will be seen from the appended localities that this species does not appear to have been substantiated much farther afield.

Hab. CAPE PROVINCE. Port Elizabeth (type); van Staadens River (Crawford); Knysna (Warren); Keurbooms R. bush, Plettenberg Bay (Barnard); Tharfield (Miss Bowker); Kowie: Grahamstown (Farquhar); Knysna; East London (J. B. L. Smith).

All the above so-called species were described from near Port Elizabeth, except crispula, of which the locality is Grahamstown.

All types are in British Museum.

# Gulella caryatis (M. & P.). Ref. List Nos. 20, 71, 78.

1898. Ennea caryatis M. & P., A.M.N.H., i, p. 24, pl. viii, f. 2. D.F.

1903. Ennea montana M. & P., A.M.N.H., xii, p. 599, pl. xxxi, f. 15. D.F.

1909. Ennea parallela M. & P., A.M.N.H., iv, p. 489, pl. viii, f. 9. D.F.

1914. Ennea montana (= parallela) M. & P., Bnp., Ann. Natal Mus., iii, p. 75, pl. v, f. 60-66. D.F.

1926. Gulella caryatis (= montana and parallela) M. & P., Bnp., Ann. Natal Mus., v, p. 366 (footnote).

1932. Gulella caryatis (=montana and parallela) M. & P., Conn., Ann. Natal Mus., vii, p. 78. N.

Shell very small, narrow cylindrical, more or less silky. Sides straight and parallel, summit, 2 whorls, bluntly rounded. Whorls 7, convex, last 5 increasing very slowly, first 2 smooth, remainder sculptured with comparatively distant, regular, straight, vertical striae, strong for some variable distance below the suture and then weakening, often fading altogether, from the middle of whorl; suture well defined. Aperture quadrate, well rounded at base, dentition 4- to 5-fold: a short oblique angular lamella; a tooth with small external pit on centre of labrum, either single and pointed or blunt and weakly bicuspid; a tubercle on left edge of base and a blunt, deep-set columellar lamella.

The typical form varies from 2.9 to  $3.5 \times 1.12$  to 1.27; last whorl about 1.7 mm.

Hab. CAPE PROVINCE. Cradock (type of caryatis); Grahamstown (montana and parallela); Martindale (Farquhar); Prieska (Gibbons; Gould).

All types in British Museum.

Specimens from the type-localities vary considerably in strength of sculpture and shape of labral tooth, while the Prieska race is larger, with 8 whorls,  $5.0 \times 1.4$ , last whorl 2.2 mm., and the striation, while more oblique than in type, extends in equal strength across the whorls, without emphasis at the suture, and the labral tooth is more clearly bifid; it appears, however, inadvisable to add a further name to this difficult group without more extended knowledge of intermediate forms.

var. diabensis n. (Pl. ii, f. 1.)

Differs from all examples of *caryatis* that I have seen in having more convex whorls and stronger sculpture, which extends in equal strength right across the later whorls. The type contains 7 whorls and measures: long. 3.5, lat. 1.2; last whorl 1.4 mm.

Hab. GREAT NAMAQUALAND. Diab R. (Edlinger). Type in Berlin Museum.

(i, a) Minutiae.

## Gulella isipingoënsis (Stur.). Ref. List No. 57.

1898. Ennea isipingoënsis Stur., S.A. Moll., p. 27, pl. i, f. 19. D.F.

1898. Ennea isipingoënsis var. cylindrica Stur., ibid., p. 27, pl. i, f. 22. D.F.

1914.  $Ennea\ isipingoënsis\ (= var.\ cylindrica)$  Stur., Bnp., Ann. Natal Mus., iii, p. 33, pl. iii, f. 1. D.F.

1925. Gulella isipingoënsis Stur., Bnp., Ann. Natal Mus., v, p. 113, pl. viii, f. 15–17. N.F.

Shell very small, cylindric-oval, silky. Sides slightly convex, summit,  $3\frac{1}{2}$  whorls, obtusc. Whorls  $7\frac{1}{2}$ , very convex, first 2 smooth, remainder sculptured with strong, close, regular, straight, oblique costulae, finer behind the labrum; suture very deep. Aperture subcircular, dentition 5-fold; a strong oblique angular lamella; a large squarish labral tooth, more or less bicuspid, upper cusp often lacking; a small denticle on right centre of base, which in some races becomes a low ridge or practi-

cally disappears; a denticle on extreme left of base and a deep-set, scoop-shaped columellar lamella. The type measures

Long. 2.83, lat. 1.47; last whorl 1.42 mm.; Burnup (1925) gives full account as to the presence of apertural armature in the young shells of this species.

Hab. NATAL. Isipingo (types, Penther); widely distributed along the south coast and as far inland as Pietermaritzburg.

CAPE PROVINCE. Knysna (Hewitt); Ingeli Forest (Falcon); other records now transferred provisionally to var. cathcartensis Bnp. Types in Vienna Museum.

Hewitt's set of 5 appear to be quite inseparable from the normal form, as exemplified in a Pietermaritzburg pair in my collection; one of the Knysna shells is extremely ovate, the others cylindrical: in all there is a mid-basal tubercular ridge and the labral tooth is shortly, bluntly bifid.

## var. discrepans Stur.

1898. Ennea isipingoënsis var. discrepans Stur., S.A. Moll., p. 27, pl. i, f. 20. D.F.

1898. Ennea isipingoënsis var. simillima Stur., S.A. Moll., p. 27, pl. i, f. 21. D.F.

1914. Ennea isipingoënsis var. discrepans (= var. simillima) Stur., Bnp., Ann. Natal Mus., iii, p. 35, pl. iii, f. 2-3. D.F.

1925. Ennea isipingoënsis var. discrepans (?) Stur., Bnp., Ann. Natal Mus., v, p. 113, pl. viii, f. 18–19. N.F.

Of more obese contour than type, labral tooth longer and wider, with minute denticle on upper edge, and columellar lamella also larger, so that these processes overlap, the former above the latter; the denticle on right of base is replaced by a low ridge.

Long. 2.7-3.55, lat. 1.45-1.78 mm.; young shells have apertural dentition.

Hab. NATAL. Isipingo (type, Penther); Equeefa; Umbogintwini (Burnup); Winkel Spruit (Akerman); Southport (Puzey).

CAPE PROVINCE. Emagusheni, Pondoland (Puzey).

Types in Vienna Museum.

# var. sturanyi Bnp.

1914. Ennea isipingoënsis Stur., var. sturanyi Bnp., Ann. Natal Mus., iii, p. 36, pl. iii, f. 4-6. D.F.

1925. Gulella isipingoënsis Stur., var. sturanyi Bnp., Ann. Natal Mus., v, p. 113, pl. viii, f. 20–27. N.F.

Differs from type in dentition, the labral tooth longer, wider and more compact, ending in a blunt or rounded point; columellar lamella also larger, and basal denticle replaced by a low ridge, as in var. discrepans, from which it differs in being more cylindrical, labral process less massive and more pointed, and entirely lacking the denticle on its upper edge.

Long. 2.57-3.25, lat. 1.47-1.55 mm.; young shells possess apertural dentition.

Hab. NATAL. Ntimbankulu (type); Pietermaritzburg; Howick; Dargle (Burnup); Zwaart Kop; Hilton (Falcon); Karkloof (Taynton). Type in British Museum.

## var. cathcartensis Bnp.

1925. Gulella isipingoënsis Stur., var. cathcartensis Bnp., Ann. Natal Mus., v, p. 121, pl. viii, f. 28–30. D.F.

More cylindric than type, summit more rounded and less tapering, whorls scarcely so convex, suture less deep, and costulae slightly weaker and more distant; aperture more trigonal, baso-columellar tooth situate a little higher up and basal denticle absent; ends of peristome slightly farther apart; an immature shell of 6 whorls shows baso-columellar tooth and columellar lamella both stronger than other forms of this species at the same stage of growth.

Long. 3.4, lat. 1.6; last whorl 1.5 mm.

Hab. CAPE PROVINCE. Thomas River, Cathcart (type); The Gorge, Van Staaden's River? (Farquhar); Katherg? (Cruden); east side of the Heads, Knysna (Smith).

Type in British Museum.

Although not authenticated, it is probable that the three records last mentioned refer to this variety; the five Knysna specimens agree with Burnup's description in having more distant lirae and very slightly less convex whorls than type, but the apex is tapering rather than rounded, and the basal columellar denticle in much the same position as in the type; the angular lamella strong, as in cathcartensis; 2 shells have a low, deep-set, mid-basal ridge or shelf; in all the labral tooth is short and narrower than in typical isipingoënsis, 4 out of 5 being more or less distinctly, though not prominently, bicuspid; in only one is the lower cusp much longer than the upper.

### var. dextrorsa Bnp.

1925. Gulella isipingoënsis Stur., var. dextrorsa Bnp., Ann. Natal Mus., v, p. 123, pl. viii, f. 31–32. D.F.

Differs from type and foregoing varieties in generally smaller size, rather coarser sculpture, stronger development of angular lamella, somewhat tripartite labral tooth, with small cusps above and below the longer central one; absence of basal denticle and stronger process on left of base, which is low oblong, rather than acute.

The whorls vary in number from  $6\frac{3}{4}$  to  $7\frac{1}{2}$ , and size from  $2\cdot62$  to  $3\cdot07\times1\cdot31$  to  $1\cdot52$  mm. in length and breadth; no young shells have been examined for apertural dentition.

Hab. ZULULAND. Eshowe (Burnup & Falcon). Type in British Museum.

var. laevorsa Bnp.

1925. Gulella isipingoënsis Stur., var. laevorsa Bnp., Ann. Natal Mus., v, p. 124, pl. viii, f. 33-34. D.F.

Differs from the other varieties in dentition, which is as follows: a short vertical angular lamella; a most minute denticle at top of sinus; a wide labral base with deep external foss, bearing two strong pointed denticles, the lower more deep-set; another most minute denticle below it, so far inset as to be hardly discernible; a small sharp denticle on extreme left of base and a deep-set columellar lamella, consisting of a large flattish lobe produced into two bluntly mamillate points.

Founded on 5 specimens, ranging from  $2.6 \times 1.34$  (7 whorls) to  $3.18 \times 1.44$  mm.

with  $7\frac{3}{4}$  whorls.

Hab. ZULULAND. Eshowe (Burnup & Falcon).

Type in British Museum.

Burnup remarks that "it is with some little diffidence that I nominate this and the preceding form (dextrorsa) as varieties of isipingoënsis, for the distinctions are not confined to one or two characters, but can be detected in many. The general appearance of the shells, however, the size, form, swollen whorls, deep suture, and strong sculpture suggest a relationship closer than merely generic, so it seems best . . . to give these forms a status corresponding with that of discrepans, sturanyi, and cathcartensis as varieties of isipingoënsis, thus emphasizing their probable affinity with that species."

(ii) Practically smooth.

Gulella instabilis (Stur.).

Ref. List No. 56.

1898. Ennea instabilis Stur., S.A. Moll., p. 24, pl. i, f. 9. D.F.

Shell small, cylindriform, smooth and glossy. Sides of spire straight or barely convex, summit, 3 whorls, obtusely rounded. Whorls 7, nearly flat, sculptured only with very short, oblique striolae in the median sutures; suture shallow. Aperture quadrate, rounded at base, dentition 5-fold: a strong, somewhat oblique angular lamella; a very low labral base, with a deep external pit, bearing at each extremity a pointed denticle, the lower about twice as large as the upper; a strong pointed denticle on left centre of base and a strong, bluntly rounded columellar lamella. The type set ranged from 5-4 to 6-8 mm.; an average example from Equeefa measures

Long. 6.0, lat. 2.7; apert. alt. 1.4, lat. 1.2; last whorl 3.3 mm.

Hab. NATAL. Isipingo; Durban (type set, Penther); coast bush generally, from Port Shepstone to Tongaat, and several inland localities as far north as Table Mountain (Burnup).

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ZULULAND. Enkwalini Valley, 12 miles north of Eshowe (Falcon).

CAPE PROVINCE. Port St. John's (Warren); Thomas R., Cathcart (Farquhar, fide Burnup); East London (Kincaid).

Type in Vienna Museum.

While usually fairly constant in size, certain races of this common species are not quite typical, that from East London being more elongate, and that from the Enkwalini Valley rather shorter, 4.8 mm., with more sculpture, the striolation, which is present on the last suture, extending a little farther down, as well as right across the last half of the body whorl; the labral denticles are comparatively a little shorter and more nearly equal in size.

## Gulella kosiensis (M. & P.). Ref. List No. 60.

1908. Ennea kosiensis M. & P., A.M.N.H., i, p. 130, pl. vii, f. 2. D.F.

Similar in all respects to the foregoing, except that the 7 nearly flat whorls are entirely smooth and the upper labral denticle is always a little stronger, more or less, than the lower. A topotype measures

Long. 5.2, lat. 2.4; apert. alt. (intern.) 1.2, lat. 1.1; last whorl 3.1 mm.

Hab. ZULULAND. Kosi Bay (type); Eshowe; Lower Umfolosi Drift (Burnup); St Lucia and False Bays (Bell Marley); Eshowe-Empangeni Road (Falcon); Mtumzini; Hluhluwe Game Reserve (Rump).

NATAL. Gingindhlova; Greenwood Park (Miss Hickey); Wyebank (Puzey); Durban Bluff (Falcon).

Type in British Museum.

The races from Durban and Eshowe Road are considerably larger than type, one from the last-named locality measuring  $7\times3$ , last whorl  $4\cdot2$  mm., though quite typical in other respects.

Gulella obovata (Pfr.). Ref. List No. 76.

1855.  $Ennea\ obovata\ Pfr.,\ P.Z.S.,\ p.\ 9.$ 

1898. ,, ampullacea Stur., S.A. Moll., p. 24, pl. i, f. 14-15. D.F.

Typically, though not constantly, a little smaller and with slightly more convex sides than *instabilis*, which it resembles in every respect, including sculpture and relative strength of labral denticles, excepting that the basal denticle is situate more to the left, low on the columella, and the columellar lamella is comparatively broader at its base and very obtusely triangular, thus being far less conspicuous

than in the other species; a Durban example (paratype of ampullacea) with  $7\frac{1}{2}$  nearly flat whorls measures

Long. 5·1, lat. 2·5; apert. alt. 1·2, lat. 1·2; last whorl 3·9 mm.

Hab. NATAL. Isipingo; Durban (type set of ampullacea, Penther); common in southern districts.

Type of obovata in British, ampullacea in Vienna Museum.

G. obovata was described as from Liberia, obviously one of the many miasmas arising from the pestilential conchological swamp of the Cuming collection; the species seems to be confined to Natal.

Gulella ingens (Stur.). (Pl. i, f. 1.)

Ref. List No. 55.

1898. Ennea ingens Stur., S.A. Moll., p. 23, pl. i, f. 9. D.F.

Shell large, rimate, cylindrical, smooth and glossy. Spire much produced, sides straight and parallel, summit round. Whorls  $8\frac{1}{2}$ , nearly flat except 4th and 5th, slowly increasing, the later microscopically sculptured with very close, fine, faint, nearly straight vertical striolae and an occasional growth line, with partial traces of such extremely fine, close, and weak spiral lineation as to be of negligible importance; suture shallow. Aperture trigonal, peristome not fully formed, dentition 5-fold; a strong angular lamella; a low base, bearing 2 blunt but prominent teeth (the upper minutely bifid) with a deep external pit, unusually low down the labrum; a large blunt tubercle on left centre of base and a large, bituberculate lamella, with a deep groove along its upper surface, at upper angle of columella.

Long. (type) 9·1, lat. 3·2; apert. alt. (intern.) 1·2, lat. 1·2; last whorl 3·7 mm.

Hab. NATAL. Durban (Penther).

Type in Vienna Museum.

Owing to immaturity of the unique type it is impossible to decide whether the dental processes have attained their final stage of development, but the bituberculate form of the columellar lamella seems to debar this huge, narrow shell from being an overgrown monstrosity of other smooth members of its group, such as *kosiensis*, which might otherwise easily be the case.

## Gulella planidens (Mts.).

1881. Ennea laevigata Dhrn. (pars), Smith, P.Z.S., p. 281, pl. xxxii, f. 6.\* N.F.

1892. Ennea planidens Mts., Sitz.-Ber. Ges. Nat. Fr. Berlin, p. 179. D.

1897. Ennea (Gulella) planidens Mts., D.O.A., iv, p. 21, pl. ii, f. 16. D.F.

1899. Ennea (Gulella) laevigata Dhrn. (pars), Smith, P.Z.S., p. 580. N. 1904. Ennea (Gulella) planidens Mts., Kob., Conch. Cab., p. 206, pl. xxvi, f. 5-6. D.F.

1913. Ennea (Gulella) quinquedentata C. Bttg., Proc. Mal. Soc., x, p. 349, pl. xv, f. 7. D.F.

1914. Ennea laevigata Dhrn., Dautz. & Germ., Rev. Zool. Afr., iv, p. 8. L.

1916. Ennea (Gulella) quinquedentata Bttg., Germ., Bull. Mus. Paris, p. 247. D.

1916. Ennea laevigata Dhrn., Germ., ibid., p. 247. D.

1919. Gulella laevigata Dhrn. (= planidens Mts.), Pilsb., Bull. Amer. Mus. N.H., xl, p. 218.  $\,$   $\,$   $\,$   $\,$   $\,$   $\,$   $\,$   $\,$  D.F.

1925. Gulella, cf. laevigata Dhrn., Conn., Trans. R. Soc. S. Africa, xii, p. 120. N.L.

Shell of fair size, cylindrical, smooth and glossy. Sides straight and parallel, summit,  $4\frac{1}{2}$  whorls, convex conoid. Whorls 8, nearly flat, practically smooth but for weak infrasutural beading, rarely extending into striolae, on the last 2 whorls; suture shallow. Aperture broadly trigonal, rounded at base, dentition 5-fold: a strong, slightly oblique angular lamella; an inconspicuous labral base, corresponding to a large square external pit, bearing 2 strong, straight, parallel denticles, well separated from each other, equal in size or the upper slightly longer; a small denticle on left of base and a simple mamillate columnlar lamella.

Long. 9.0, lat. 4.2; apert. alt. (intern.) 1.7, lat. 2.1; last whorl 4.5 mm.

Hab. LORENZO MARQUES. Maforga Siding, B. & M. Railway (McDowell).

Type of planidens in Berlin Museum, quinquedentata in coll. C. R. Boettger.

The shell described, from Northern Rhodesia, has been found by Dr. Rensch to agree well with the type of *planidens* and to be of average size, but the species varies somewhat in this respect, and the Maforga race, though quite typical, is a little more slender, ranging from  $7.5 \times 3.8$  to  $9.2 \times 4$  mm.

This species has been confused owing to Smith having misidentified and figured it in 1881 as laevigata Dhrn., in which, in point of fact, the upper labral denticle, instead of being single and narrow, is clearly bifid; the true laevigata has never been figured under its own name, but in 1893 Smith redescribed it (P.Z.S., p. 633, pl. lix, f. 2) under that of karongana, the figure of which gives a perfect representation of Dohrn's species; its distribution appears to be confined to the immediate vicinity of Lake Nyasa, but planidens, which was described from the Belgian Congo, ranges through Tanganyika, Rhodesia, and Nyasaland into Portuguese East Africa. G. quinquedentata was

described from Kipatimu, T.T.; the figure and description leave no doubt as to its being identical with planidens.

Gulella lissophanes (M. & P.). (Pl. i, f. 9.)

Ref. List No. 10.

1892. Ennea aperostoma var. lissophanes M. & P., A.M.N.H., ix, p. 93. D.

Treated by M. & P. as a variety of the delicately striolate aperostoma, the present species is quite smooth and glossy, while the two labral denticles, of which the upper is a little longer, are situate lower down the labrum and a little closer together, being marked by an external pit of ordinary shape, features that seem worthy of specific distinction. The type and a second example, each with  $7\frac{1}{2}$  whorls, measure

Long. 7·8, lat. 3·2; apert. alt. (intern.)  $1\cdot0$ , lat.  $1\cdot2$ ; last whorl  $4\cdot3$  mm. ,  $7\cdot2$ , ,,  $3\cdot3$ ; ,,  $1\cdot2$ , ,,  $1\cdot3$ ; ,,  $4\cdot6$  mm.

Hab. NATAL (Layard).

Type in British Museum.

Gulella barbarae Conn.

1929. Gulella barbarae Conn., Ann. Natal Mus., vi, p. 221, pl. xiv, f. 1-2. D.F.

1932. Gulella barbarae Conn., Ann. Natal Mus., vii, p. 79. N.

A rather small, cylindrical shell, smooth and glossy, with from 6 to 7 whorls, the last 3 showing extremely close, faint, regular, oblique microscopic striation. Aperture nearly square, peristome reflexed, dentition normally 5-fold, a long blunt angular lamella, 2 labral denticles, the upper the stronger, a small sharp denticle well to left of base, and a rather deep-set square columellar lamella, with a deep groove along the centre; but in some specimens there is an additional process in the form of a tubercle half-way up the columella, whose presence might occasion doubt as to whether this species should be placed in Group 4 or 11. The type measures

Long. 5·7, lat. 2·5; apert. alt. 1·2, lat. 1·2; last whorl  $3\cdot 2$  mm., but the species attains a length of 6·5 mm.

Hab. ZULULAND. Mfongosi District (Jones).

Type in South African Museum.

A topotype has been recorded from which the angular lamella is absent, its place being taken by a short sharp denticle in centre of paries.

Gulella maritzburgensis (M. & P.).

Ref. List No. 67.

1893. Ennea maritzburgensis M. & P., A.M.N.H., xii, p. 107, pl. iii, f. 11. D.F.

1914. Ennea maritzburgensis M. & P., Bnp., Ann. Natal Mus., iii, p. 64, pl. iv, f. 39-41, 45-46. D.F.

Shell very small, subcylindriform, smooth and glossy. Sides of spire nearly straight or slightly swollen towards the summit of  $3\frac{1}{2}$  whorls, which is bluntly rounded. Whorls 7, slightly convex, sculptured just below the median sutures with short oblique striolae, which extend very occasionally lower down, and from suture to base on the last half-whorl; suture well defined. Aperture quadrate, rounded at base, dentition 5-fold: a strong oblique angular lamella; a low labral base, with single external pit, bearing at each extremity a pointed denticle, the lower far stronger; a small denticle on left centre of base and a strong triangular columellar lamella. A topotype of average size measures

Long. 4.2, lat. 2.0; apert. alt. 0.9, lat. 0.8; last whorl 2.3 mm.

Hab. NATAL. Pietermaritzburg (type, Burnup); Isolo (Godfrey); Karkloof R., 2 miles from Hilton (Falcon); Nottingham Road (Taynton); Rosetta (Miss Hickey).

CAPE PROVINCE. East London (Radford; Kincaid).

Type in British Museum.

The typical form, of which the animal is bright red, appears almost confined to the Maritzburg district; the race from Rosetta is nearly as small as var. *contracta*, but the aperture larger; that from Hilton has a bright yellow animal and is rather large, labral and columellar processes much weaker and basal rather so than in type; the East London race is rather small, with usually a very slight swelling near top of columellar lip.

## var. contracta Bnp.

1914. Ennea maritzburgensis M. & P., var. contracta Bnp., Ann. Natal Mus., iii, p. 66, pl. iv, f. 42–44. D.F.

Smaller and more ovate than type, whorls  $6\frac{1}{2}$ , with finer, fainter sculpture, rounder aperture with comparatively weaker dentition, labral denticles smaller and closer together, the upper frequently lacking.

Long. 3.3, lat. 1.6; last whorl 1.7 mm.

Hab. NATAL. Nottingham Road (type); Curry's Post; Karkloof (Taynton); Bulwer; Otto's Bluff (Puzey).

Type in British Museum.

## Gulella polita (M. & P.).

Ref. List No. 88.

1893. Ennea polita M. & P., A.M.N.H., xii, p. 108, pl. iii, f. 12. D.F.

1925. Gulella polita M. & P., Bnp., Ann. Natal Mus., v, p. 140, pl. ix, f. 45–46. D.F.

The type resembles maritzburgensis in every respect except for being smaller, entirely smooth all over, and the labral process a little more like a tooth with 2 cusps, the lower the stronger, the upper present in the type, but absent from a paratype in my collection. The type has 7 whorls and measures

Long. 3·3, lat. 1·6; last whorl 2·1 mm.

Hab. CAPE PROVINCE. Tharfield (type, Miss Mary Bowker); Alicedale; Port Elizabeth (Cruden); East London (Kincaid); Kowie; Bathurst (Farquhar).

Type in British Museum.

The Alicedale race, treated by Burnup, and that from Port Elizabeth are larger than type, attaining dimensions of  $4.5 \times 1.9$  mm. with the same number of whorls, and the last half-whorl is very finely striolate instead of smooth.

The smallest example from East London is only  $2.9 \times 1.4$  mm.

## Gulella burnupi (M. & P.). Ref. List No. 15.

1897. Ennea burnupi M. & P., A.M.N.H., xix, p. 634, pl. xvii, f. 2. D.F.

Shell of fair size, more or less fusiform, smooth and glossy. Sides of spire regular, usually slightly convex, tapering from 6th whorl upward to a blunt point. Whorls 8½, flat, sculptured after first 2, under a lens, with very faint striolae, slightly more visible below the sutures, which are well defined. Aperture quadrate, rounded at base, dentition 5-fold: a short oblique angular lamella; 2 short acute denticles, the lower the stronger, on a low labral base; a small thin denticle on left centre of base, and a convex, bluntly pointed columellar lamella.

Long. 7.9, lat. 3.8; apert. alt. 1.2, lat. 1.2; last whorl 3.8 mm.

Hab. NATAL. Pietermaritzburg (type); Gordon Falls and Zwartkop Valley (Burnup); Bulwer; Henley Waterworks (Warren); Elandskop (Puzey); Donnybrook (Rump).

Type in British Museum.

A species of arboreal habit, first collected on a leaf of *Dracaena*; it is somewhat easily recognisable by its rather obese contour and elongated acute summit.

(ii, a) Minutiae.

# Gulella columnella (M. & P.).

Ref. List No. 24.

1901. Ennea columnella M. & P., A.M.N.H., viii, p. 316, pl. ii, f. 2 D.F.

1914. Ennea columnella M. & P., Bnp., Ann. Natal Mus., iii, pp. 57, 58, pl. v, f. 47. N.D.F.

Shell minute, subcylindrical, smooth and glossy. Sides of spire parallel, scarcely convex, summit broadly rounded. Whorls  $5\frac{1}{4}$ , nearly flat, last 4 nearly equal, sculptured with exceedingly weak, close, microscopic transverse striolae, arched forward and only plainly discernible just below the sutures, and on some shells distinct traces of microspiral lineation. Aperture quadrate, dentition 5-fold: a prominent, nearly vertical angular lamella; a two-cusped labral tooth; a denticle on left of base and a horizontal lamella, entering from the surface near top of columellar margin.

Long. 2.15, lat. 1.0; last whorl 1.2 mm.

Hab. NATAL. Karkloof Bush (type, McBean); Dargle; Edendale; Ntimbankulu; Lower Umkomaas (Burnup); Park Rynie; Isipingo (Puzey).

Type in British Museum.

Distinguishable from other species of similar size by the partly superficial form of the columellar lamella.

# var. vitreola M. & P. Ref. List No. 105.

1908. Ennea vitreola M. & P., A.M.N.H., i, p. 130, pl. vii, f. 3. D.F. 1914. ,, columnella, var. vitreola M. & P., Bnp., Ann. Natal Mus., iii, p. 59. N.

Differs from type through more ovoid contour with rather shallower sutures, and slightly weaker development of peristomatal processes; the four specimens known measure  $1.87 \times 0.94$ ,  $1.82 \times 0.92$ ,  $1.81 \times 0.93$ , and  $1.76 \times 0.92$  mm.

Hab. NATAL. Hilton Road (Burnup).

Type lost; paratypes in British and Natal Museums.

# Gulella mooiensis (Bnp.).

1914. Ennea mooiensis Bnp., Ann. Natal Mus., iii, p. 62, pl. v, f. 49–51. D.F.

Shell very small, elongate elliptical, smooth and glossy. Sides scarcely convex, summit,  $2\frac{1}{2}$  whorls, bluntly rounded. Whorls  $5\frac{1}{2}$ , moderately convex, practically devoid of transverse sculpture except just behind the labrum, but showing faint traces of microspiral lineation, as in the foregoing species; suture shallow. Aperture roundly triangular, dentition 5-fold: a strong angular lamella; a double midlabral tooth; a small denticle on left of base and a scoop-shaped columellar lamella; there is also a slightly raised ridge within the basal lip, extending round the base from behind the labral tooth.

Long. 2.55, lat. 1.24; last whorl 1.35 mm.

Hab. NATAL. Game Pass, Upper Mooi R. (type, Burnup); Mont aux Sources (Puzey).

CAPE PROVINCE. Mt. Currie, Kokstad (Falcon).

Type in British Museum.

Differs from the preceding species in absence of infrasutural striation and minor details of dentition.

# Gulella fraudator sp. n. (Pl. ii, f. 3.)

Shell very small, rimate, subcylindrical with rounded ends, smooth and glossy. Spire produced, sides very slightly convex. Whorls  $6\frac{1}{2}$ , little convex, sculpture, only visible under the microscope, confined to weak, somewhat irregular, slightly curved and oblique growth wrinkles, more regular and stronger for some distance behind the labrum and on lower part of back of last whorl; suture very shallow. Aperture quadrate, dentition 6-fold: a strong oblique angular lamella; a large tooth with 2 cusps, lower the larger, on centre of labrum, corresponding to a deep external pit; a strong mid-basal denticle, also with deep, narrow external pit; a strong tubercle just above centre of columellar lip and a large, simple, deep-set columellar lamella.

Long. 2.75, lat. 1.2; last whorl 1.5 mm.

Hab. CAPE PROVINCE. Mbotjie Beach bush (Falcon). Type in British Museum.

## Gulella bushmanensis Bnp.

1926. Gulella bushmanensis Bnp., Ann. Natal Mus., v, p. 364, pl. xxi, f. 17–18. D.F.

Shell very small, narrowly cylindrical, smooth and glossy. Sides nearly straight and parallel, summit, 2 whorls, bluntly rounded. Whorls 7, nearly flat, last 5 increasing very slowly, practically sculptureless; suture well defined. Aperture quadrate, rounded at base, dentition 5-fold: a short angular lamella; a minutely bicuspid labral tooth; a small denticle on left of base and a moderately deep-set, simple columellar lamella. The type measures

Long. 2.94, lat. 1.0; last whorl 1.19 mm.

Hab. NATAL. Weenen Hill (type) and several localities in Weenen District (Burnup; Thomasset).

ZULULAND. Mfongosi (Jones).

Type in British Museum.

While resembling *pentheri* and *mariae* in form, the dentition places this species in a different group from either.

Group 5. Dentition more or less 6-fold, 3 labral denticles.

(i) More or less strongly striate.

# Gulella gouldi (Pfr.). Ref. List No. 49.

1855. Ennea gouldi Pfr., Mal. Blätt., ii, p. 174. D.

1898. ,, ,, ,, var. excedens Stur., S.A. Moll., p. 18, pl. i, f. 3. D.F.

1932. Gulella gouldi Pfr., Conn., Ann. Natal Mus., vii, p. 82. N.F.

Shell of fair size, cylindrical or slightly barrelled, with silky sheen. Sides of spire straight or very slightly convex, summit,  $2\frac{1}{2}$  whorls, bluntly rounded. Whorls  $7\frac{1}{2}$ , not very convex, first 2 smooth, remainder sculptured with close, regular, nearly straight, oblique transverse costulae; suture well defined. Aperture quadrate, rounded at base, dentition 6-fold: a strong, nearly vertical angular lamella; 3 sharp, short denticles, of which the upper is the smallest, arising from a broad low labral base, with a single corresponding external depression; a similar denticle on left centre of base and a simple, convex, bluntly pointed columellar lamella. An average shell measures

Long. 8·2, lat. 3·8; apert. alt. 1·5, lat. 1·5; last whorl 3·9 mm., but the species varies enormously in size, almost every intermediate existing between large forms  $11\cdot5\times5\cdot0$ ,  $10\cdot0\times4\cdot0$ , and  $9\cdot5\times4\cdot2$ , and small ones  $6\cdot4\times3\cdot0$  and  $6\cdot5\times3\cdot1$  mm. in length and breadth; Sturany's var. excedens was founded on a specimen from Durban with 9 whorls,  $9\cdot5\times4\cdot0$  mm., but the name is hardly worth perpetuating.

Hab. NATAL. Durban (type, Plant); common throughout southern districts.

CAPE PROVINCE. Bathurst (in coll. Farquhar, fide Burnup); Port St. Johns (Puzey); Mbotjie Beach, Pondoland (Falcon).

Type of gouldi in Stettin, var. excedens in Vienna Museum.

## Gulella crossleyana (M. & P.). Ref. List No. 32.

1893. Ennea crossleyana M. & P., A.M.N.H., xii, p. 106, pl. iii, f. 8. D.F.

1932. Gulella crossleyana M. & P., Conn., Ann. Natal Mus., vii, pp. 82, 84. F.D.

An exact miniature of the foregoing except for slightly more slender contour; an average specimen with 7 whorls measures

Long. 5·8, lat. 2·7; apert. alt. 1·0, lat. 0·8; last whorl 2·9 mm., while the size varies from  $6\cdot 2 \times 2 \cdot 6$  down to  $4\cdot 6 \times 2 \cdot 4$  mm.

Hab. NATAL. Pietermaritzburg (type, Mrs. Crossley) and Slang Spruit (Burnup, typical form); Hilton Road (abnormal, Falcon).

Type in British Museum.

Four shells from Hilton Road, the largest of which is  $7.1 \times 2.75$  mm., are remarkable in the presence of a minute denticle (in one case a mere swelling) on the columellar lip, just below the lamella; a

similar feature exists in occasional examples of gouldi and sexdentata, so that it hardly merits varietal rank.

### Gulella pretoriana Conn.

1932. Gulella pretoriana Conn., Ann. Natal Mus., vii, p. 86, pl. iv, f. 11. D.F.

Shell of fair size, silky, cylindrical. Sides of spire parallel, summit broadly rounded. Whorls  $7\frac{1}{2}$ , rather flat, first  $1\frac{1}{2}$  smooth, remainder covered with strong, close, regular, nearly straight, oblique costulae; suture beaded, shallow. Aperture subquadrate, rounded at base, dentition 6-fold: a strong angular lamella; a flat labral slab, corresponding to a single external depression, bearing three denticles, the lowest single and distinct, the upper forming a double tooth of which the lower cusp is slightly longer; a denticle of same length on left centre of base and a large square columellar lamella.

Long. 6.4, lat. 2.7; apert. alt. 1.3, lat. 1.1; last whorl 2.9 mm.

Hab. TRANSVAAL. Zwart Kop, Pretoria (Connolly).

Type in British Museum.

Differs from xysila, with which it was for long confounded, in having stronger, continuous striation and in greater size of upper labral denticle.

Gulella tridens sp. n.

(Pl. i, f. 13.)

Shell small, cylindrical, silky, sides straight and parallel, apex broadly mamillate. Whorls  $6\frac{1}{2}$ , convex, last 4 almost equal, first 2 practically smooth, remainder sculptured, except on front of body whorl, with close, straight, regular, slightly oblique costulae; suture simple, rather deep. Aperture quadrate, rounded at base, peristome white, glossy, expanded and reflexed, dentition 6-fold: a strong, somewhat oblique angular lamella; 3 conspicuous, nearly equidistant labral denticles, corresponding to a long external pit, in which there are 2 depressions separated by a minute col; upper and central, of which the latter is usually the longer, a little nearer the surface than the lowest, which is nearly as long as the central; a strong denticle on left centre of base and a large, square, deep-set columellar lamella with a deep groove down the centre, almost dividing it into 2 cusps as in *Molarella*.

Long. 5.25, lat. 2.2; apert. alt. 1.0, lat. 0.8; last whorl 2.9 mm.

Hab. ZULULAND. Mfongosi District (Jones).

Type in British Museum.

The shell varies a little in length and considerably in the size of the highest and lowest labral denticles, though these are typically as described above, presenting somewhat the appearance of a short-pronged trident. Possibly, however, through interbreeding, numerous examples undergo a gradual transition into the 7-toothed *leucocion* from the same locality, which they resemble closely but for lacking the extra columellar tubercle characteristic of that species; on this transitional form of *tridens* I bestow the name

var. intermedia, nov.

(Pl. i, f. 14.)

Differs from type in position of labral denticles, the upper two more closely united on a square base and the lowest more deeply immersed; occasionally, too, there is vestige of a columellar tubercle, as in *leucocion*.

Hab. ZULULAND. Mfongosi (Jones).

Type in British Museum.

(i, a) Minutiae, all labral teeth united in a single large process.

Gulella arnoldi (Stur.).

Ref. List No. 11.

1898. Ennea arnoldi Stur., S.A. Moll., p. 28, pl. ii, f. 26-30. D.F. ,, ,, var. elongata Stur., ibid., p. 29, pl. ii, f. 31. D.F.

1914.  $Ennea\ arnoldi$  Stur., Bnp., Ann. Natal Mus., iii, p. 68. N.F. 1925. Gulella ,, (= var. elongata) Stur., Bnp., Ann. Natal Mus., v, p. 104, pl. viii, f. 1–2. N.F.

Shell very small, cylindrical, silky. Sides normally straight and parallel, summit, 2 whorls, bluntly mamillate. Whorls 6–7, very convex, first 2 smooth, remainder sculptured with strong, close, regular costulae, curved and oblique on 3rd to 5th, straight and vertical on last whorl; suture deep. Aperture narrow oblong, much constricted, dentition 4-fold: a strong oblique angular lamella; a large triangular slab, with horizontal external pit, occupying the entire labrum; a small denticle in centre of base and a long, low, deep-set columellar lamella, almost concealed by the superficial processes.

Long. 2.8, lat. 1.25; last whorl 1.6 mm., but the length varies from about 2.55 to 3.1 mm., the var. *elongata*, with 7 whorls, being of the latter dimension, but, as mentioned by Burnup, not worth varietal distinction.

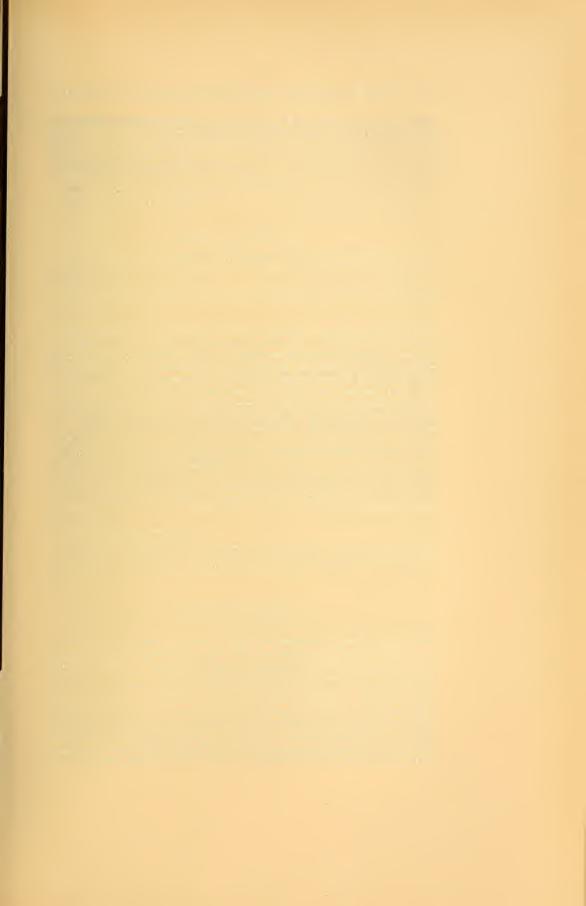
Hab. NATAL. Isipingo (type and var. elongata, Penther); rather widely distributed about the south coast (Burnup); Southport (large form, Puzey).

Types in Vienna Museum.

The Southport race is larger, with more convex sides than type, and 7 whorls, of which the last 5 are costulate; long. 3.5, lat. 1.9; last whorl 2.1 mm. No armature has been found in the aperture of young shells of this species, an important fact in view of its presence in G. phyllisae, discussed hereunder.

## var. collaris Bnp.

1925. Gulella arnoldi Stur., var. collaris Bnp., Ann. Natal Mus., v, p. 109, pl. viii, f. 9-14. D.F.



nearly meeting the labral process and hiding from frontal view another rounded tubercle a little further inset on the columellar wall.

Long. 2.5, lat. 1.3; last whorl 1.5 mm.

Hab. CAPE PROVINCE. Ingeli Forest, Griqualand East-Natal Border (Falcon).

Type in British Museum.

(ii) Practically smooth and glossy.

### Gulella sexdentata (Mts.).

1869. Ennea laevigata Dhrn., var. sexdentata Mts., Nachr.-Bl. D. Mal. Ges., i, p. 154. D.

1890. Ennea hanningtoni Smith, A.M.N.H., vi, p. 161, pl. vi, f. 4. D.F.

1897. Ennea (Gulella) sexdentata (=hanningtoni Smith) Mts., D.O.A., p. 22. N.

1925. Gulella sexdentata Mts., Conn., Trans. R. Soc. S. Africa, xii, p. 117. N.

Exactly similar in dentition to *gouldi*, but the shell is usually larger, with straight sides, smooth and glossy, entirely devoid of sculpture but for a few scattered irregular growth lines; a typical example with 8 flat whorls measures.

Long. 10.5, lat. 4.2; apert. alt. 2.0; lat. 2.0; last whorl 5.25 mm. Martens' specimens were 9.5 to  $10 \times 4$  to 5 mm., and hanningtoni  $10 \times 5$  mm., but a couple of shells collected by myself at Dar-es-Salaam are only  $8.6 \times 3.8$  and  $7.7 \times 3.7$  mm., thus falling to the average size of gouldi. The upper labral denticle is occasionally lacking, and there is rarely a minute additional denticle on the columellar lip.

Hab. TRANSVAAL. Barberton (Déglon); Pepiti Falls, Sibasa (Harries).

S. RHODESIA. Sebakwe, near Gwelo (in South African Museum). LORENZO MARQUES. Dondo; Zangwe Basin; Mtisherra R. Valley (Cressy).

Type of sexdentata in Berlin, hanningtoni in British Museum.

The types were described from Zanzibar and Tanganyika Territory, the South African records having only recently been established.

#### Gulella alutacea Conn.

1932. Gulella alutacea Conn., Ann. Natal Mus., vii, p. 84, pl. iv, f. 16. D.F.

A smooth, rather dull, cylindrical shell with parallel sides and bluntly rounded summit. Whorls  $7\frac{1}{2}$ , nearly flat, first  $2\frac{1}{2}$  faintly microscopically decussate, remainder sculptured with regular, nearly straight, slightly oblique transverse striae, so faint as to be hardly noticeable except below the suture; parallel to

and between these, the surface is covered with extremely close, fine, microscopic granulate striolae; suture simple, shallow. Aperture quadrate, narrowly rounded at base, dentition, in type, 7-fold: a prominent curved angular lamella; 3 small labral denticles with a single external depression; a thin denticle on left centre of base, a smaller one, nearer the surface, at base of columella, and a large quadrate columellar lamella, convex, but usually with a slight well near its base.

Long. 7.4, lat. 3.2; apert. alt. 1.5, lat. 1.4; last whorl 4.0 mm.

Hab. NATAL. Cascade Falls, Karkloof (Falcon).

Type in British Museum.

The denticle at base of columella is not a constant feature, being sometimes absent or represented by a slight swelling, and the columellar lamella varies in shape from nearly square to triangular, but the shagreened microscopic sculpture separates this species from others of its group, and is extremely unusual among African Gulellae.

## Gulella xysila (M. & P.). Ref. List No. 109.

Ennea xysila M. & P., A.M.N.H., xix, p. 97, pl. vi, f. 6. D.F.
 Gulella xysila M. & P., Conn., Ann. Natal Mus., vii, p. 85. D.

A narrow cylindrical shell with  $8\frac{1}{2}$  flat whorls, practically devoid of sculpture except for short infrasutural beading on the last  $4\frac{1}{2}$ , and a few strong, continuous striae just behind the labrum. The dentition consists of a strong angular lamella, a flat labral slab, corresponding to a single external groove, bearing trace of 3 denticles, the lowest single and distinct, the central of the same length and bearing a small upper tubercle; a small denticle on left centre of base and a strong square columellar lamella. A typical example from Pienaars Poort measures

Long. 8·0, lat. 2·7; apert. alt. 1·2, lat. 1·1; last whorl 3·5 mm., and the smallest of the same series, with  $7\frac{1}{2}$  whorls, is  $5\cdot7\times2\cdot5$ , last whorl 3·2 mm. The dentition varies, but is never stronger than as described above.

Hab. TRANSVAAL. Johannesburg (type, Johnson); Pretoria District (McBean); Pienaars Poort, Pretoria (Connolly); Heidelberg (Miss Livingston).

Type in British Museum.

Differs from *pretoriana* in that the sculpture is confined to the sutural region and the upper labral denticle is far weaker.

# var. hyalina M. & P. Ref. List No. 109.

1907. Ennea xysila, var. hyalina M. & P., A.M.N.H., xix, p. 97, pl. vi, f. 6a. D.F.

A little race which seems confined to the type-locality and may be worthy of a local name; there is no sculpture except beading below the median su\*ures, absent

from face of body whorl, and the 7 whorls are slightly less flat than in xysila. My

largest paratype is

Long. 5·3, lat. 2·1; last whorl 2·85 mm., while another is only 5·0 mm. in length; it will be seen that the shell is comparatively a little more slender than the normal form.

Hab. TRANSVAAL. Daspoort, Pretoria (McBean). Type in British Museum.

## Gulella aliciae (M. & P.). Ref. List No. 9.

1907. Ennea aliciae M. & P., A.M.N.H., xix, p. 95, pl. vi, f. 1. D.F.

Shell large, cylindrical, smooth and glossy. Spire with straight, parallel sides, summit, 5 whorls, broadly triangular. Whorls 9, flat, last 3 nearly equal, perfectly smooth except for a little striation just behind the labrum. Aperture somewhat triangular, rounded at base, dentition 5- to 6-fold; a strong oblique angular lamella; a base, nearly filling the labrum, with a deep external pit, with 2 short denticles at its lower end and centre, and an obtuse angle, rather than a tooth, at its upper end; a strong denticle to left of base, and a strong, deep-set triangular columellar lamella.

Long. 9.0, lat. 4.5; apert. alt. (intern.) 2.0, lat. 2.0; last whorl 4.75 mm.

Hab. ZULULAND. Makowe (type, Burnup); Dukuduku Forest (Toppin).

Type in British Museum.

Group 6. Dentition 6-fold, 2 denticles on labrum and 1 in sinulus.

(i) More or less strongly striate.

# Gulella warreni (M. & P.). Ref. List No. 107.

1903. Ennea warreni M. & P., A.M.N.H., xii, p. 601, pl. xxxi, f. 7. D.F.

Shell of fair size, normally cylindrical, silky. Sides straight and parallel, or narrowing very slightly above the penultimate whorl, summit, 4 whorls, convex-conoid. Whorls 8, nearly flat, last 6 sculptured with very close, regular, straight, slightly oblique striae; suture shallow. Aperture quadrate, rounded at base, dentition 6-fold: a strong, nearly vertical angular lamella; a minute denticle above middle of sinulus; a long labral base with deep external pit, bearing a short pointed denticle at its upper, and a large triangular one at its lower extremity; a pointed denticle on left centre of base and a strong mamillate columellar lamella. The type measures

Long. 10·0, lat. 4·3; apert. alt. 1·5, lat. 1·7; last whorl 5·6 mm., while the largest specimen examined is  $11\cdot8\times4\cdot8$  mm.

Hab. ZULULAND. Lower Umfolosi Drift (type, Warren); Makowe (Crosly); Melmoth (Miss Hickey); Mfongosi; St. Lucia Bay (Rump). CAPE PROVINCE. Port St. John's (Shortridge).

Type in British Museum.

The sinular denticle, a regular feature in this species, is unusually weak in the type and was overlooked in the original description.

## Gulella pulchella (M. & P.). Ref. List No. 90.

1893. Ennea pulchella M. & P., A.M.N.H., xii, p. 108, pl. iii, f. 13. D.F.

1926. Gulella pulchella M. & P., Bnp., Ann. Natal Mus., iii, p. 374, pl. xxi, f. 24-26. D.F.

Shell rather small, cylindrical, slightly silky. Sides straight and parallel or very slightly swollen, summit, 4 whorls, convex-conoid. Whorls 8, but little convex, last 6 sculptured with regular, nearly straight, oblique striae, which are closer, finer, and vertical on last half and very faint on front of body whorl; suture well defined. Aperture quadrate, rounded at base, dentition 6-fold: a strong, nearly vertical angular lamella; a small sinular denticle; a very low labral base, with rectangular external pit, bearing two short, acute, well-separated denticles; a small denticle on left centre of base and a strong pointed columellar lamella.

Long. 6.0, lat. 3.0; apert. alt. 1.2, lat. 1.2; last whorl 3.1 mm.

Hab. NATAL. Chase Krantz, Pietermaritzburg (type, Burnup; Falcon).

CAPE PROVINCE. Port St. John's (Puzey).

Type in British Museum.

Burnup's measurements of topotypes range from  $5.8 \times 3.1$  to  $6.3 \times 3.2$  mm.; the race from Port St. John's is comparatively more obese, with rather more convex whorls, and generally larger than type, an example with 8 whorls measuring  $6.7 \times 3.4$ , and another with  $7\frac{1}{7}$  whorls  $6.0 \times 3.4$  mm.

# Gulella distincta (M. & P.).

Ref. List Nos. 36, 44.

1893. Ennea distincta M. & P., A.M.N.H., xi, p. 22, pl. iii, f. 10. D.F.

1898. Ennea eximia M. & P., A.M.N.H., i, p. 28, pl. viii, f. 8. D.F. 1922. Gulella distincta (=eximia) M. & P., Conn., Proc. Mal. Soc., xv, p. 71. N.

1925. Gulella distincta M. & P., Conn., Trans. R. Soc. S. Africa, xii, p. 121. N.

Shell rather large, cylindrical, silky. Sides straight and parallel, summit, 4 whorls, convex-conoid. Whorls 8, nearly flat, 1st smooth, 2nd very faintly, VOL. XXXIII.

and remainder strongly sculptured with close, regular, straight, oblique costulae; suture shallow. Aperture quadrate, rounded at base, dentition normally 6-fold; a short, nearly vertical angular lamella; a minute sinular denticle; a labral tooth, usually divided into 2 small cusps, but sometimes single and acute; a swelling or tubercle on left of base, and an immersed oblique columellar shelf. A paratype measures

Long. 10.9, lat. 4.7; apert. alt. 2.1, lat. 2.0; last whorl 5.4 mm.

Hab. TRANSVAAL. Middelburg (distincta, Crawford); between Barberton and Delagoa Bay (eximia, fide M. & P.); Barberton (Déglon).

Both types in British Museum.

Distincta was described as  $12 \times 4\frac{1}{2}$  and eximia as  $9 \times 4$  mm., with slightly different dentition, but intermediates both in size and dentition occur, and eximia is, at most, only retainable as a varietal name if it be desired for the smaller shells with a single labral tooth and little appearance of basal swelling.

The presence of a sinular denticle relegates this species to the present group, but its natural alliance is with the other two large costate forms, *crassilabris* and *sibasana*, which are peculiar to the Mid and Northern Transvaal.

Gulella cairnsi (M. & P.). (Pl. i, f. 3.) Ref. List No. 16.

1897. Ennea cairnsi M. & P., A.M.N.H., xix, p. 634, pl. xvii, f. 1. D.F.

1932. Gulella cairnsi M. & P., Conn., Ann. Natal Mus., vii, p. 79. N.

The type is a comparatively short, cylindriform shell of fair size, with 8 flattish whorls, the first 4 forming the broad, conic summit, last 3 almost equal, sculpture on the last  $6\frac{1}{2}$  consisting of close, regular, straight, slightly oblique costulae. Aperture squarely quadrate, rounded at base, dentition 6-fold: a strong, rather straight angular lamella; a minute denticle opposite it rather near top of sinus, and two larger, the lower the longer and more superficial, half-way down the labrum, corresponding to a single external cavity; a smaller denticle on left centre of base, and a simple, nearly horizontal columellar lamella, arising nearer the surface than is frequently the case in the genus.

Long. 7.7, lat. 4.0; last whorl 4.0 mm.

Hab. CAPE PROVINCE. Mouth of Buffalo River (type, ex Cairns; Burnup); East London District (Smith); Port St. John's (Warren; Puzey).

ZULULAND. Hluhluwe Game Reserve (Rump).

Type in British Museum.

Some of the race from Port St. John's are considerably larger than typical, usually from 10 to  $11 \times 5$  mm. in length and breadth, but all specimens I have seen are constant in dentition.

The original description mentions only 5 teeth, overlooking the small sinular denticle, while it is difficult to believe that the execrable figure, perpetrated by one whom Pilsbry has rightly dubbed an incompetent artist, can represent the same shell, being ovate, with at least 1 extra whorl, and omitting the 6th denticle. I therefore refigure the species from a topotype in my collection,  $7.4 \times 4.0$  mm., similar to the type, but in better condition.

## Gulella genialis (M. & P.). Ref. List No. 48.

1903. Ennea genialis M. & P., A.M.N.H., xii, p. 598, pl. xxxi, f. 14. D.F.

1926. *Gulella genialis* M. & P., Bnp., Ann. Natal Mus., v, p. 378, pl. xxi, f. 27–28. *D.F.* 

A small, cylindriform, dull, silky shell with broadly conical apex,  $8\frac{1}{2}$  convex whorls, with form and sculpture as in *crassidens*, but deeper suture; dentition of same pattern, but angular lamella bifid, an inner and an outer point separated by a depression, and obscuring the minute sinular denticle from frontal view; the labral slab, more immersed below than above, bears a minute denticle on its upper edge, and is notched near the middle by a groove running thence upward towards the outer lip, while the basal denticle is narrower and more to the left than in Pfeiffer's species. The type measures

Long. 5.2, lat. 2.5; last whorl 2.5 mm.

Hab. ZULULAND. Patana (type); Lower Umfolosi Drift (Burnup); Eshowe-Empangeni Road (Falcon).

Type in British Museum.

# Gulella vallaris (M. & P.). Ref. List No. 48.

1907. Ennea vallaris M. & P., A.M.N.H., xix, p. 96, pl. vi, f. 5. D.F. 1912. ,, ,, (as synonyn of genialis M. & P.), Conn., Ann. S.A. Mus., xi, p. 74.

1926. Gulella vallaris M. & P., Bnp., Ann. Natal Mus., v, p. 382, pl. xxi, f. 29–30. D.F.

Smaller and comparatively broader than *genialis*, with coarser sculpture, flatter whorls and less vertical aperture; the type is cylindriform, with 8 flattish whorls, rather shallow but well-defined suture, angular lamella slightly notched and nearly obscuring the sinular denticle, as in *genialis*, but the labral process consists of 2

short, sharp, distinct cusps, arising from a common base with an oval external depression; basal and columellar process as in the foregoing species.

Long. 3.6, lat. 1.8; last whorl 2.2 mm.

Hab. ZULULAND. Melmoth (type, Miss Hickey); Richard's Bay (Falcon).

Type in British Museum.

As it was on Burnup's authority that I originally placed this species in the synonymy of *genialis*, I willingly adopt his more considered opinion in restoring it to specific rank!

## (ii) Practically smooth.

## Gulella penningtoni Bnp.

1925. Gulella penningtoni B<br/>np., Ann. Natal Mus., v, p. 130, pl. viii, f. 36–38.  $\ D.F.$ 

Shell small, elongate elliptical, smooth and glossy. Sides usually slightly convex, summit,  $3\frac{1}{2}$  whorls, convex-conoid. Whorls  $7\frac{1}{2}$ , nearly flat, sculptured, after first 2, with very close and fine, almost microscopic striae; suture shallow. Aperture quadrate, rounded at base, dentition 6-fold, as in group, an unusually large and long angular lamella, small sinular denticle, 2 well-defined labral denticles, the lower the longer, a pointed denticle on left of base and a mammiform columellar lamella.

A paratype measures long. 5.5, lat. 2.6; last whorl 2.7 mm., and the shortest I have seen is 5.2 mm. long.

Hab. NATAL. Sinkwazi Beach bush (type, Pennington).

ZULULAND. Eshowe (Burnup & Falcon).

Type in British Museum.

The Eshowe race are smaller than type, comparatively more obese, with even finer sculpture, only visible under a microscope; the largest example is  $4.6 \times 2.1$ , last whorl 2.3 mm., and smallest  $3.7 \times 2.1$  mm. No armsture has been observed in young shells.

The sinular denticle renders the present species easily distinguishable from such as resemble it in other respects.

Group 7. No denticle in sinus, but a minute tubercle in centre of paries.

Gulella perplexa sp. n.

(Pl. i, f. 7.)

Shell very small, rimate, cylindriform, rather dull and silky. Spire nearly straight-sided, summit  $(3\frac{1}{2}$  whorls) bluntly conoid. Whorls  $6\frac{1}{2}$ , little convex, last 3 nearly equal, first  $2\frac{1}{2}$  smooth, remainder sculptured with close, regular slightly curved costulae, which are nearly vertical on the last 2 whorls; suture simple, shallow. Aperture quadrate, narrowing and rounded at base, peristome slightly expanded, dentition 6-fold: a minute mid-parietal tubercle; a slightly

oblique angular lamella; a long labral process with 2 blunt cusps, the lower rather the longer; a small denticle on left of base, and a long, thin lamella, sloping slightly downward from the horizontal, near top of columella.

Long. 3.5, lat. 1.6; apert. alt. (intern.) 0.7, lat. 0.9; last whorl 2.1 mm.

Hab. CAPE PROVINCE. Emagusheni, Pondoland (Puzey). Type in British Museum.

It is rather remarkable that, while in most South African species of Gulella with simple columellar process and 5- or 6-fold dentition in the usual positions, the columellar lamella is deep-set and somewhat blunt, in those with extra sinular or mid-parietal denticles it is thin, acute, and situate nearer the surface, and the fact that it is thus in the present species leads me to infer that the parietal tubercle, although so small, may be a constant feature. It is the only South African species yet known to possess this process without the accompaniment of a sinular denticle, which obviates the necessity of differentiating it in detail from others of the class.

Group 8. Dentition 7-fold, 5 teeth as in Group 4, plus minute denticles on sinulus and centre of paries.

(i) More or less strongly striate.

Gulella separata (Stur.). (Pl. i, f. 4.)

Ref. List No. 96.

1898. Ennea separata Stur., S.A. Moll., p. 20, pl. i, f. 7-8. D.F. " Conn., Ann. Natal Mus., vii, p. 79. N. 1932. Gulella ,,.

Shell of fair size, typically subfusiform or acuminate ovate, silky. Sides convex, summit, 5 or 6 whorls, regularly conoid, apex obtuse. Whorls 8, little convex, first 5 or 6 regularly increasing in breadth and altitude, remainder subequal, last narrowed towards base; first 2 smooth, remainder sculptured with strong, close, regular, straight, vertical costulae; suture well defined. Aperture quadrate, rounded at base, dentition 7-fold: a strong, somewhat oblique angular lamella; a minute denticle above middle of sinulus; a very low base, with deep external pit, bearing at each extremity a small pointed cusp, the lower slightly stronger; a pointed denticle towards left of base; a narrow, superficial, horizontal lamella near top of columella and a small tubercle on centre of paries. A typical example measures

Long. 7.0, lat. 4.0; apert. alt. (intern.) 1.3, lat. 1.5; last whorl 3.5 mm.

Hab. NATAL. Isipingo; Durban Bluff (type, Penther); widely distributed from the coast to Pietermaritzburg.

CAPE PROVINCE. Port St. John's (small form 4.6 × 2.3 mm., Warren); Makwa Falls, Pondoland (Falcon).

Type in Vienna Museum.

A beautiful shell, remarkable in its typical form for obese contour, vertical sculpture, and possession of both sinular and parietal denticles.

A race attributable to this species from Margate, Natal (Rump) (pl. i, f. 4), is in some respects so unlike the normal form that I considered it at first glance to be distinct; the shells are far smaller than type and cylindrical, with straight parallel sides, and the columellar lamella may point slightly downward, instead of horizontally, but the sculpture and apertural dentition are so nearly identical that there seems no reason for even a varietal name, in view of probable discovery of intermediates. The dimensions are: long. 5·7, lat. 2·8; last whorl 2·8 mm.

(ii) Practically smooth.

Gulella zelota (M. & P.). Ref. List No. 110.

1907. Ennea zelota M. & P., A.M.N.H., xix, p. 97, pl. vi, f. 7. D.F.

Shell small, cylindriform, smooth and glossy. Sides parallel, straight or very slightly convex, summit, 4 whorls, rounded. Whorls 8, nearly flat, microscopically sculptured with extremely weak, somewhat irregular growth striolae; suture shallow, with margined appearance. Aperture quadrate, rounded at base, dentition 7-fold, as in *separata*: a strong, slightly oblique angular lamella, minute parietal and sinular denticles, acute denticle towards left of base, narrow, horizontal, superficial lamella near top of columella and bicuspid labral base, the lower cusp longer, upper shorter and typically single, but often flattened and bearing 2, or even 3 minute cusps. A typical example measures

Long. 5·1, lat. 2·2; last whorl 2·8 mm., while the shortest examined is 4·3 mm.

in length.

Hab. NATAL. Port Shepstone (type); Equeefa (Burnup); Southport (Puzey); Umtamvuma Bush; Port Edward (Falcon).

Type in British Museum.

Easily distinguished from its confrères by glossy surface combined with possession of both parietal and sinular denticles.

Group 9. Dentition 9-fold; finely striate.

Gulella enneodon Conn.

1922. Gulella enneadon Conn., A.M.N.H., x, p. 114.  $\, D. \,$ 

1925. ,, enneodon ,, Trans. R. Soc. S. Africa, xii, p. 116, pl. iv, f. 3. N.F.

Shell rather small, tun-shaped, rimate, glossy. Spire produced, sides slightly convex, apex bluntly rounded. Whorls 7–8, nearly flat, gradually increasing, first

2 smooth, remainder covered with close fine striae, only just visible without a lens; suture shallow. Aperture nearly square, dentition 9-fold: a small sharp denticle in centre of paries; a large, curved angular lamella; a large bifid tooth, with blunt cusps of nearly equal size, half-way down the labrum; 2 minute denticles between that and base; a small sharp basal tooth and a 2-cusped columellar lamella, the upper cusp longer, emerging to the outer margin, the lower distinct and more inset. The type with 7½ whorls measures

Long. 6.2, lat. 3.3; apert. alt. 1.7, lat. 1.2; last whorl 3.5 mm., but the shell varies in length and relative contour, the largest example seen, cylindrical, with 8 whorls, measuring  $8.0 \times 3.5$ , apert. 1.6, last whorl 4.1, and the smallest, truncate ovate, with

7 whorls,  $5.8 \times 3.0$ , apert.  $1.5 \times 1.2$ ; last whorl 3.3 mm.

Hab. LORENZO MARQUES. District north of Macequece (Cressy).

Type in British Museum.

In a curious deformity from the type-locality the large labral tooth is single, but there is an additional small denticle on left of base. The only near relation to this well-marked species is the next,

> Gulella perissodonta (Stur.). (Pl. i, f. 16.)

> > Ref. List No. 82.

1898. Ennea perissodonta Stur., S.A. Moll., p. 26, pl. i, f. 18. D.F. 1925. Gulella ,, Conn., Trans. R. Soc. S. Africa, xii, p. 116. N.

A very small, silky, subcylindrical shell, with 6 convex whorls, similar to the foregoing in texture, sculpture, and dentition, except that the lower labral cusp is very long and the upper very short, and the columellar lamella more immersed, so that both rounded cusps are nearly on the same plane, instead of the upper emerging to the surface.

Long. (type) 4.2, lat. 2.1; last whorl 2.3 mm.

Hab. LORENZO MARQUES. Delagoa Bay (Penther).

Type in Vienna Museum.

Unless intermediates occur, this unique shell should be easily separable from enneodon by its much smaller size, more convex whorls, deeper suture, and the above-mentioned differences in dentition.

> Group 10. Section Molarella Conn., 1922 (A.M.N.H., x, p. 500).

> > Type Ennea consanguinea Smith.

Principal columellar process 2-fold, usually resembling a prominent 2-cusped molar tooth, though in individual specimens the cusps may not develop and in certain species the molar may be divided into the appearance of 2 single teeth.

Gulella darglensis (M. & P.). Ref. List No. 34.

1908. Ennea darglensis M. & P., A.M.N.H., i, p. 130, pl. vii, f. 1. D.F.

1914. Ennea darglensis M. & P., Bnp., Ann. Natal Mus., iii, p. 48, pl. iv, f. 32. D.F.

A very small shell with 6 flattish whorls, last 4 increasing gradually in length, sculptured with fairly strong, regular, nearly straight and vertical striae: dentition 5-fold: a strong, short, angular lamella; prominently bicuspid palatal plait; denticle on left centre of base and bicuspid columellar lamella.

Long. 2.6, lat. 1.2; last whorl 1.5 mm.

Hab. NATAL. Dargle (type); Richmond; Inhluzani Mountain (Burnup); Karkloof; Nottingham Road (Taynton); Bulwer (Alexander).

CAPE PROVINCE. Pirie Forest (Godfrey); Mhlozana, Pondoland (Puzey); Tonti Forest, near Mt. Ayliff (Falcon).

Type in British Museum.

The Pirie race has  $6\frac{1}{2}$ -7 whorls, last 5 strongly sculptured, palatal plica narrower, with the form of a double tooth, and the columellar lamella almost triple, owing to a strong formation below the lower cusp.

var. illovoensis Bnp.

1914. Ennea darglensis M. & P., var. illovoensis Bnp., Ann. Natal Mus., iii, p. 49, pl. iv, f. 33-35. D.F.

Differs from type in its smoother, glossier surface.

Hab. NATAL. Ntimbankulu, Mid-Illovo (Burnup). Type in British Museum.

Group 11. Section *Plicigulella* Pilsb., 1919 (Bull. Amer. Mus. N.H., xl, p. 216). Type *G. bistriplicina* Pilsb.

Columellar lamella strongly triplicate.

Gulella vicina (Smith).

1899. Ennea (Gulella) vicina Smith, P.Z.S., p. 580, pl. xxxiii, f. 1–2. D.F.

1904. Ennea (Gulella) vicina Smith, Kob., Conch. Cab., p. 225, pl. xxviii, f. 4-5. D.F.

Shell of medium size, cylindriform, rimate, smooth, glossy, transparent, pale olivaceous. Spire produced, sides straight and parallel, apex, 3 whorls, bluntly rounded. Whorls 6½, rather flat, gradually increasing, last 4 sculptured with very fine, close, regular, oblique striolae, stronger just behind the labrum; aperture small, quadrate, peristome white, glossy, and moderately expanded, dentition 10-or 11-fold: a strong angular lamella; a large base, occupying nearly the entire labrum, bearing a strong lower and a rather smaller upper tooth, with an external depression behind each, the upper divided into 2 cusps, the lower the larger; 3 distinct denticles filling up the base and a strong 3-pronged lamella at the top of the columella; there is also, more often than not, a minute tubercle on the centre of the paries.

Long. 7.0, lat. 3.0; apert. alt. (intern.) 1.5, lat. 1.5; last whorl 4.2 mm.

Hab. S. RHODESIA. Vumbu Mts., Umtali, 5700 feet (Arnold).

Described from Nyasaland and extending northward to the Taru

Desert.

Type in British Museum.

#### Gulella aprosdoketa sp. n.

(Pl. ii, f. 4.)

Shell very small, rimate, cylindrical, smooth and glossy. Spire produced, sides straight and parallel, apex rounded. Whorls 7, nearly flat, gradually increasing, perfectly smooth but for occasional hardly visible miscroscopic growth lines; suture shallow. Aperture quadrate, dentition as follows: a strong, incurved, somewhat bifid angular lamella; a superficial slab, corresponding to a horizontal external pit, and bearing a single pointed denticle at its lower and a larger, slightly bifid one, parallel to the angular lamella, at its upper end, both running inward as a short low col and terminating in another small tubercle; a strong, shortly entering plait on left centre of base and a very large, strong, 3-pronged columellar lamella.

Long. 3.7, lat. 1.6; last whorl 1.7 mm.

Hab. CAPE PROVINCE. Isinuka Sulphur Springs, Port St. John's (Falcon).

Type in British Museum.

B. Columellar process duplex, there being a superficial process on the upper columellar margin in addition to the lamella.

Group 12. Dentition 6-fold, i.e. as in Group 4, plus the extra columellar process.

(i) More or less strongly striate.

## Gulella pentodon (Morel.).

Ref. List No. 80.

1889. Ennea natalensis Morel., J. de C., xxxvii, p. 11, pl. ii, f. 1. D.F. 1889. Ennea pentodon (=natalensis Morel., 1889, non Crvn., 1880) Morel., ibid., p. 200. Emend.

1898. Ennea binominis Stur., S.A. Moll., p. 18. N.

Shell cylindrical, of fair size, dull and silky. Sides straight and parallel, summit, 3 whorls, obtusely rounded. Whorls 7, last 4 increasing very slowly in altitude, last 5 sculptured with close, regular, nearly straight, slightly oblique transverse costae. Aperture quadrate, rounded at base, peristome white, glossy and expanded, dentition 6-fold; a strong curved angular lamella; a broad labral base, with a deep external pit, bearing 2 strong cusps, the lower twice the size of the upper; a strong narrow mid-basal denticle; a pronounced round superficial tooth near the top of, and a large deep-set lamella, with a deep well at its root, at the upper angle of the columella. An average paratype measures

Long. 7.0, lat. 3.0; apert. alt. 1.3, lat. 1.2; last whorl 3.5 mm., but two others of about the same breadth are 7.5 ( $7\frac{1}{2}$  whorls) and 6.5 mm. ( $6\frac{1}{2}$  whorls) in length.

Hab. CAPE PROVINCE. Port Elizabeth (Crawford). Type in British Museum.

### Gulella euthymia (M. & P.). Ref. List No. 43.

1893. Ennea euthymia M. & P., A.M.N.H., xii, p. 107, pl. iii, f. 10. D.F.

Similar in shape to foregoing, but much smaller with slightly more convex whorls, of which there are 7, the costulae on the last 5 being straight and practically vertical; dentition somewhat as in *pentodon*, but the angular lamella is comparatively longer, extending nearly half-way down the aperture, the labral base is much lower, so that the denticles are hardly united on it, and the basal denticle is situate on left of base; columellar processes as in *pentodon*, but lamella not hollowed.

Long. 4.6, lat. 2.3; last whorl 3.0 mm.

Hab. NATAL. Thornybush (type, Burnup); Karridene (Puzey); a larger form at Lower Umkomaas (Burnup), Illovo R. (Taynton), and Isipingo.

Type in British Museum.

## Gulella falconi Bnp.

1925. Gulella falconi B<br/>np., Ann. Natal Mus., v, p. 137, pl. ix, f. 43–44.  $\,$ <br/> $\,$   $\,$   $\,$   $\,$   $\,$   $\,$   $\,$ 

Easily separable from the last by more convex whorls, slightly weaker costulation, and the columellar lip being somewhat pinched in at its upper extremity, imparting a narrower appearance to the aperture; the labral denticles are strong and separate, the lower far larger; basal long and narrow; marginal process of columella a long, flat, usually straight slab, extending nearly its entire length and developing occasionally a distinct cusp at each end; columellar lamella blunt and convex. The type set, with 7 whorls, are said to vary from  $3\cdot4\times2$  to  $4\cdot6\times2\cdot1$  mm. in length and breadth; in a specimen 4 mm. long the last whorl is  $2\cdot2$  mm.

Hab. NATAL. Port Shepstone (type, Falcon; Burnup); Port Edward (smaller form, Rump).

Type in British Museum.

The Port Edward race, with slightly weaker sculpture, is noticeably smaller, one of the largest with  $6\frac{1}{2}$  whorls measuring: long.  $3\cdot 2$ , lat.  $1\cdot 7$ ; last whorl  $1\cdot 8$  mm.

## Gulella phragma (M. & P.).

Ref. List No. 86.

1907. Ennea phragma M. & P., A.M.N.H., xix, p. 95, pl. vi, f. 3. D.F.

A small, slender, cylindrical, silky shell with  $6\frac{1}{2}$  whorls, but little convex, first 2 smooth, remainder sculptured with strong, straight, fairly close, regular, slightly oblique striae; aperture quadrate, hardly rounded at base, dentition as in the group, upper labral denticle practically absent, columellar process exactly duplicated by the presence of a strong, blunt superficial tooth, with another, similar, inset in the same position immediately under it within the aperture.

Long. 4·3, lat. 1·7; last whorl 2·1 mm.

Hab. CAPE PROVINCE. Waku, Cathcart District, near the Klipplatz River (Miss Hickey).

Type in British Museum.

Distinguished by its perfectly cylindrical contour, extreme weakness of upper labral denticle, and strength of superficial tubercle on the columella.

#### Gulella godfreyi Bnp.

1925. Gulella godfreyi Bnp., Ann. Natal Mus., v, p. 135, pl. ix, f. 41-42. D.F.

Closely allied to the foregoing, from which it differs in its flatter whorls, of which there are 7, sculptured as in *phragma*, with similar dentition except that the upper labral denticle, though very weak, is stronger, and the superficial columellar process a mere tubercle, far smaller than in M. & P.'s species.

Long. 4.7, lat. 1.9; last whorl 2.5 mm.

Hab. CAPE PROVINCE. Ugie, Maclear District (Gavin & Godfrey).

Type in British Museum.

### Gulella tripodium sp. n.

(Pl. i, f. 11.)

Shell very small, rimate, cylindrical, rounded at ends, regularly costulate. Whorls 8, last 5 moderately convex, very slowly increasing, first 2 smooth, remainder covered with close, very regular, nearly straight, slightly oblique costulae; suture well defined. Aperture quadrate, rounded at base, markedly inclined downwards to the left; dentition 7-fold: a strong, short, nearly square angular lamella, hollow on its right side; a 3-fold labral process, corresponding to a single large external pit, and consisting of a small but prominent blunt superficial tubercle, with a smaller sharper one, more deeply inset, just above, and a

long, in-running plait below; a small denticle on left of base; a shortly entering, horizontal plait near top of columella and a very large and nearly square columellar lamella; callus white, thick and continuous.

Long. 3.6, lat. 1.6; last whorl 1.5 mm.

Hab. CAPE PROVINCE. East London (type, J. L. B. Smith); Makwa Falls, Pondoland (Falcon).

Type in South African Museum.

Easily separable from the last species by the peculiar labral process and the superficial columellar plait being almost at the top, instead of half-way up the columella. The Makwa pair are shorter than type by  $\frac{1}{2}$  mm., but otherwise typical; all are remarkable for the sinistral declivity of the aperture.

#### Gulella swaziensis Conn.

1932. Gulella swaziensis Conn., Ann. Natal Mus., vii, p. 89, pl. iv, f. 15. D.F.

Shell small, suboval, silky. Spire rather short, sides slightly convex, summit,  $3\frac{1}{2}$  whorls, broadly conoid. Whorls 6, convex, first 2 smooth, remainder sculptured with strong, regular, close, transverse costae, weaker and oblique on 3rd and 4th, stronger and vertical on last 2 whorls; suture impressed. Aperture subquadrate, rounded and only slightly attenuate at base, dentition 5-fold: a low, prominent angular lamella; a strong acute denticle, corresponding to a deep external pit, half-way down the labrum; a smaller denticle at centre of base; another on left of base at its junction with columella, and a strong square columellar lamella.

Long. 3.8, lat. 2.25; apert. alt. 1.3, lat. 1.0; last whorl 2.5 mm.

Hab. SWAZILAND Bremersdorp (Preston Stewart).

Type in British Museum.

The presence of the extra denticle on left of the basal one places this species in the present division, while its situation at base of columella and the squat shell distinguish it readily from all other known forms.

## Gulella linguidens sp. n.

(Text-fig. 4.)

Shell small, cylindriform with rounded ends, partly smooth. Spire produced, sides parallel. Whorls 7, last 2 nearly flat, first 2 smooth, remainder sculptured in and shortly below the suture with close, strong, regular, wrinkles, which extend across the 4th whorl and just behind the labrum but fade out less than half-way across the others. Aperture quadrate, peristome rather broadly reflexed, dentition 5-fold; a strong, short, oblique angular lamella; a large triangular tooth, corresponding to a deep external pit, on centre of labrum, with its apex extending into the opposite angle, bearing a minute blunt cone, hardly a tubercle, on its upper and lower sides; a small mid-basal denticle; a deep-set, rounded columellar lamella and a very low superficial swelling, only just apparent, on the inner surface of the columellar lip; parietal callus broad, continuous, white and glossy.

Long. 4·4, lat. 2·1; last whorl 2·5 mm.

Hab. ZULULAND. Hluhluwe Game Reserve (Rump).

Type in Natal Museum.

Chiefly remarkable for the large tongue-like labral process, which extends into the upper columellar angle farther than in most species.

The superficial columellar process is so slight that this little shell might almost belong to Group 4, but I think it is best placed in its present position.

(i, a) Minutiae.

Gulella connollyi (M. & P.). Ref. List No. 25.

1909. Ennea connollyi M. & P., A.M.N.H., iv, p. 486, pl. viii, f. 2. D.F.

1914. Ennea connollyi M. & P., Bnp., Ann. Natal Mus., iii, p. 69, pl. v, f. 52. N.F.

Shell very small, cylindrical, silky. Sides straight and parallel, summit, 2 whorls, rounded. Whorls 6, very convex, first 2 smooth, remainder sculptured with strong, close, regular, straight, nearly vertical costae; suture well defined.



Text-fig. 4.—Gulella linguidens Conn.

Type in Natal Museum;  $\times 7\frac{1}{4}$ .

Aperture quadrate, rounded at base, dentition normally 6-fold: a strong, straight, erect angular lamella; a bluntly pointed or squarish, faintly bicuspid labral tooth; a minute denticle on extreme right of base; a small denticle to left of base, at foot of columella, another near its top and a large, squarish, deep-set columellar lamella. An average specimen measures

Long. 3.0, lat. 1.3; last whorl 1.45 mm.

Hab. NATAL. Majuba (type, Connolly).

TRANSVAAL. Buis Kop; Hennop's River, 16 miles west of Pretoria (Connolly).

Type in British Museum.

In the Buis Kop race the upper columellar denticle is absent or represented by a hardly noticeable swelling, while in that from Hennop's River it is removed to the extreme top of columella, where it projects horizontally immediately below the paries; the species is usually found under stones in moist patches where there is a little vegetation.

> Gulella ponsonbyi (Bnp.). Ref. List No. 34 (pars).

1914. Ennea ponsonbyi Bnp., Ann. Natal Mus., iii, p. 78, pl. v, f. 67-69. D.F.

Shell very small, cylindrical, silky. Sides straight and parallel, summit, 2 whorls, bluntly rounded. Whorls 6, rather convex, first 2 smooth, remainder sculptured with fairly strong, regular, transverse costae, except for a small area on the body whorl, above the labrum instead of centre of aperture, which is smooth; suture well defined. Aperture nearly square, dentition 5- to 6-fold: a strong short angular lamella; a 2-lobed labral tooth; a small denticle just on left centre of base; a swelling, often hardly apparent, on the columellar margin and a large deep-set columellar lamella.

Long. 2.91, lat. 1.33; last whorl 1.5 mm.

Hab. CAPE PROVINCE. Gowies Kloof, Grahamstown (type, Farguhar); Port Alfred and District (Puzey); Kasongo (Hewitt); East London (Kincaid).

Type in British Museum.

In the coastal races the columellar swelling is far stronger than in type, the labral tooth longer and less bifid, the upper cusp almost lacking, and the smooth part of the body whorl occupies the usual position above centre of base, instead of to its left, as in the typical form.

#### Gulella viae Bnp.

1925. Gulella viae Bnp., Ann. Natal Mus., v, p. 143, pl. ix, f. 47-51. D.F.

Shell very small, elongate oval, silky. Sides nearly straight, summit, 2½ whorls, obtuse. Whorls  $7\frac{1}{2}$ , convex, first 2 smooth, remainder sculptured with close, regular, nearly straight and vertical costulae; suture rather deep. Aperture oblong, rounded at base, dentition 5-fold; a strong, oblique, crescentic angular lamella; a large bicuspid labral tooth with small, but deep external pit; a minute denticle on right of base; a low triangular plate on columellar margin, truncate at lower end in frontal view, and a large, deep-set, mamillate columellar lamella. The type measures

Long. 3·15, lat. 1·56; last whorl 1·52 mm., but the number of whorls varies

from  $6\frac{1}{2}$  to  $7\frac{1}{2}$ , and size from  $2.93 \times 1.55$  to  $3.35 \times 1.74$  mm.

Hab. NATAL. Van Reenen's Pass, Drakensberg (type, Burnup); Paulpietersburg (Puzey); Mont aux Sources (Bassett-Smith).

Type in British Museum.

### Gulella bassetti Bnp.

1925. Gulella bassetti Bnp., Ann. Natal Mus., v, p. 150, pl. ix, f. 55–56. D.F.

A minute, cylindriform, silky shell with rounded apex. Whorls 6, not very convex but with deep suture, first 2 smooth, remainder sculptured with close, regular, nearly straight and vertical costulae. Aperture quadrate, rounded at base, with 5 to 6 dental processes, which little obstruct it; a thin, nearly vertical angular lamella; a 2-pointed labral tooth; a small denticle a short way up and a swelling near the top of inner margin of columella and a large, bluntly pointed, deep-set columellar lamella. The type measures

Long. 2.8, lat. 1.3; last whorl 1.7 mm.; other specimens range from 2.93 to

2.66 mm. in length, the breadth remaining about 1.3 mm.

Hab. NATAL. Mnweni Valley, between Mont aux Sources and Cathkin Peak (Bassett-Smith).

Type in British Museum.

(ii) Practically smooth.

### Gulella himerothales (M. & P.).

Ref. List No. 51.

1903. Ennea himerothales M. & P., A.M.N.H., xii, p. 599, pl. xxxi, f. 13. D.F.

Shell small, cylindriform, smooth and glossy. Sides of spire usually straight, sometimes slightly convex near the top. Whorls 7, nearly flat, with practically no sculpture except very short striolae on lower margin of median sutures. Aperture subtrigonal, dentition 6-fold; a strong oblique angular lamella; 2 prominent labral denticles, the lower more or less the longer, corresponding to a single external pit; a sharp denticle on left centre of base; a strong tubercle high on inner columellar margin and a mamillate columellar lamella.

Long. 4.0, lat. 2.0; last whorl 2.4 mm.

Hab. NATAL. Port Shepstone (type, Burnup); Darlington (Akerman); Southport; Pietermaritzburg; Impolwene (narrower form) (Puzey).

CAPE PROVINCE. Port Alfred (forma minor, Hewitt). Type in British Museum.

(ii, a) Dentition as above, with minute additional denticles.

## Gulella multidentata (Stur.).

Ref. List No. 72.

1898. Ennea multidentata Stur., S.A. Moll., p. 25, pl. i, f. 16. D.F.

Shell small, cylindriform, smooth and glossy. Sides of spire straight or slightly inflated, summit, 4 whorls, round. Whorls  $6\frac{1}{2}$  to 7, nearly flat, practically smooth except for beaded striolation just below the sutures. Aperture quadrate, dentition irregular: 6 main processes, a strong, slightly oblique angular lamella; 2 strong labral denticles, the lower the longer; a sharp denticle slightly to left centre of base; a strong, nearly square tooth, usually hollowed beneath, on upper margin of columella, and a strong blunt columellar lamella: in addition to these, there are usually 2 minute denticles just below the lower labral, 2 more on right of basal denticle and frequently another on its left; others are very rarely present in irregular positions. A Durban example measures

Long. 4.3, lat. 2.1; last whorl 2.4 mm.

Hab. NATAL. Isipingo (type, Penther); Equeefa; Durban; Alexandra Junction (Burnup); Illovo R. (Taynton); Pietermaritzburg; Clairwood (Puzey).

Type in Vienna Museum.

I place this uniquely dentate species in the present group, because the minute additional processes are so small as only to be distinguishable under a strong lens.

#### Gulella umzimvubuensis Bnp.

1925. Gulella umzimvubuensis B<br/>np., Ann. Natal Mus., v, p. 133, pl. viii, f. 39–40. D.F.

Shell very small, cylindriform, smooth and glossy. Sides straight and parallel or slightly convex, summit, 3 whorls, rounded. Whorls 6½, nearly flat, last 3 sculptured immediately below the suture with very short, regular striolae, which rarely extend across the whorl except for half a dozen costulae just behind the labrum; suture shallow. Aperture quadrate, rounded at base, dentition 6-fold; a very strong and oblique angular lamella; a large triangular labral slab with usually a minute denticle on its upper edge; a small mid-basal denticle; a subvertical denticle at bottom and a stronger horizontal one near top of columella and a deep-set columellar lamella terminating in a large round bulb.

Long. 4.27, lat. 1.97; apert. alt. (intern.) 0.8, lat. 0.7; last whorl 2.13 mm.

Hab. CAPE PROVINCE. Port St. John's (Warren (type); Puzey).

Type in British Museum.

All the type set were in poor condition, the sculptural details given above being taken from fresh topotypes gathered by Puzey; the number of whorls varies from 6 to 7, and size from  $3.7 \times 1.9$  to  $5.1 \times 2.3$  mm. The two teeth on columellar margin, in addition to that on the base, are the most distinguishing features of this little species.

#### (ii, b) Minutiae.

Gulella mariae (M. & P.). Ref. List Nos. 17, 21, 66.

1892. Ennea mariae M. & P., A.M.N.H., ix, p. 92, pl. vi, f. 12. D.F. 1895. ,, cimolia ,, ,, xvi, p. 478, pl. xviii, f. 2. D.F.

1909. Ennea callista M. & P., A.M.N.H., iv, p. 485, pl. viii, f. 1. D.F.

1914. Ennea mariae (=callista) M. & P., Bnp., Ann. Natal Mus., iii, p. 61, pl. v, f. 48. N.F.

1926. Gulella mariae (=cimolia) M. & P., Bnp., Ann. Natal Mus., iii, p. 353, pl. xxi, f. 1–5. D.F.

Shell minute, cylindrical, smooth and glossy. Sides straight, summit, 2 whorls, bluntly rounded. Whorls 6, nearly flat, practically void of sculpture, suture well

defined. Aperture quadrate, dentition 6-fold: a short angular lamella; a large triangular labral base, lower side longer, bearing usually 2 small cusps; a pointed denticle on left of base; a strong tubercle half-way up the columellar margin and a rounded columellar lamella.

Long. 3.0, lat. 1.2; last whorl 1.6 mm.

Hab. CAPE PROVINCE. Craigie Burn, Somerset East (mariae, Miss Bowker); Grahamstown (cimolia and callista); Elandsberg Mountain, Cradock; Maestrom Forest, Bedford; Atherstone Kloof, 13 miles from Grahamstown; Boschberg Mts., Somerset East (Farquhar); Mt. Currie, Kokstad (Falcon).

Types in British Museum.

Burnup has proved the correctness of the above synonymy, and that many localities, assigned in my Reference List to cimolia, must be transferred to pentheri Stur., which bears considerable resemblance to immature forms of M. & P.'s invalid species.

### Gulella sylvia (M. & P.). Ref. List No. 98.

1903. Ennea sylvia M. & P., A.M.N.H., xii, p. 599, pl. xxxi, f. 4. D.F.

1914. Ennea sylvia M. & P., Bnp., Ann. Natal Mus., iii, p. 54, pl. iii, f. 18-20. D.F.

Shell minute, cylindrical, smooth, glossy, with very blunt apex. Whorls 5, nearly flat, last 4 very gradually increasing, entirely smooth but for occasional transverse scratches, suture shallow. Aperture trigonal, rounded at base, peristome strongly reflexed, dentition 7-fold: a short angular lamella; a broad 2-cusped tooth in centre of labrum; a deep-set tubercle on right, and a denticle near the surface on left of base; a strong triangular tubercle high on the columella margin and a large deep-set columellar lamella, which usually develops 2 strong cusps, the lower far the stronger, suggestive of the Section Molarella.

Long. (type) 2.6, lat. 1.0; last whorl 1.3 mm.

Hab. CAPE PROVINCE. Maestrom Forest, Bedford (type, Farquhar); East London (Kincaid).

Type in British Museum.

In the East London race there is often a small denticle deep-set below the labral process and the superficial columellar tubercle is lacking, while there is sometimes almost a third cusp below the other two on the columellar lamella.

## Gulella melvilli (Bnp.).

1914. Ennea melvilli Bnp., Ann. Natal Mus., iii, p. 55, pl. iii, f. 21-23. D.F.

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Very similar to the foregoing, but with slightly more convex whorls and consequently deeper suture; 6 whorls, last 4 showing microscopic striolae, strongest just below the suture, whereas sylvia is practically smooth. Dentition practically the same as in sylvia, except that the columellar lamella is simple and slightly scoop-shaped, not bifid, and the process on right of base is a low inconspicuous ridge; the superficial columellar tubercle is little more than a swelling caused by the inward bend of the lip, but sometimes forms a prominent tubercle. The type measures  $2\cdot 12 \times 0\cdot 9$ , last whorl  $1\cdot 0$  mm., and other examples range from  $2\cdot 6$  (7 whorls) down to  $1\cdot 94\times 0\cdot 89$  mm.

Hab. NATAL. Nottingham Road (type); Curry's Post; Fort Nottingham (Taynton); Karkloof (McBean); Dargle; Edendale (Burnup); Buccleugh; Paulpietersburg (Puzey); Balgowan (Pennington).

Type in British Museum.

Burnup described the contour as elongate oval or fusiform, but to my eye the type and 3 of 4 paratypes are perfectly straight-sided, only the 4th and shortest of the latter being almost imperceptibly wider at the 3rd whorl.

Group 13. Minute, with 4-5 teeth.

Gulella elliptica (M. & P.).

Ref. List No. 41.

1898. Ennea elliptica M. & P., A.M.N.H., ii, p. 126, pl. vii, f. 2. D.F.

1914. Ennea elliptica M. & P., Bnp., Ann. Natal Mus., iii, p. 38, pl. iii, f. 7–12. D.F.

Shell very small, elliptical, smooth and glossy. Sides nearly straight, summit, 3 whorls, bluntly rounded. Whorls 6, nearly flat, last 3 nearly equal, showing short growth lines just below the suture and extending across the last  $\frac{1}{4}$  whorl, otherwise quite smooth; suture shallow. Aperture quadrate, rounded at base, dentition 5-fold: a curved angular lamella; a strong mid-labral denticle; a tubercle just to left of base, at bottom of columella; another half-way up, and a weak immersed columellar lamella, little more than an obtuse-angled shelf. The length varies from 3 to 4, breadth from  $1\cdot65$  to  $2\cdot06$ ; last whorl about  $1\cdot5$  to 2 mm.

Hab. NATAL. Pietermaritzburg (type); Dargle; Nottingham Road; Karkloof; Hilton Road; Tyeloti; Zwaartkop; Richmond; Edendale; Tongaat; Umhlali; Stanger; Sinkwazi (Burnup); Chase Valley (Puzey); Balgowan (Pennington).

Type in British Museum.

One specimen from Balgowan lacks the upper columellar tubercle.

#### var. manca Bnp.

1914. Ennea elliptica M. & P., var. manca Bnp., Ann. Natal Mus., iii, p. 39, pl. iii, f. 13–14. D.F.

Differs from type in comparatively narrower contour and lacking the lower tooth on columellar lip.

Long. 3.76, lat. 1.74; last whorl 2.1 mm.

Hab. NATAL. Fort Nottingham (type); Curry's Post (Taynton). Type in British Museum.

In a few specimens an almost imperceptible callosity may be distinguished in place of the lower columellar tooth, and occasionally, also, slight traces of infrasutural sculpture, sometimes extending across the whorls, but such are of infrequent occurrence.

#### var. caelata Bnp.

1914. Ennea elliptica M. & P., var. caelata Bnp., Ann. Natal Mus., iii, p. 40, pl. iii, f. 15-17. D.F.

A little larger than type, comparatively more obese, and covered all over, except the earlier whorls and front of the last, with most delicate, fine, oblique striae. Long. 4.06, lat. 2.11 mm.

Hab. ZULULAND. Eshowe (Lady Saunders). Type in British Museum.

var. caelatior n.

(Pl. i, f. 5.)

Differs from the foregoing in having far stronger, crisper sculpture and in the form and position of the 2 columellar processes. There are 7 whorls, first 11/2 smooth, next with microscopic transverse, slightly oblique striae, which on those succeeding are extremely close, fine but sharp and regular, beading the suture and extending across the whorls, of equal strength throughout except on front of body whorl. Angular lamella, labral dentition and columellar lamella as in the species, but in the type and 2 others of 5 examined of the new variety the upper columellar tubercle is a mere superficial swelling and the other a most minute tubercle more deeply set below it, but in the 4th both are a little stronger and in the 5th weaker, the lower being in each case nearly on the surface.

Long. 4.7, lat. 2.4; last whorl 2.3 mm.

Hab. CAPE PROVINCE. Port St. John's (type); Makwa Falls, Pondoland (Falcon).

Type in British Museum.

Group 14. Dentition 7-fold, there being 3 more or less distinct labral denticles.

(i) More or less strongly striate.

#### Gulella leucocion Conn.

1929. Gulella leucocion Conn., Ann. Natal Mus., vi, p. 223, pl. xiv, f. 5. D.F.

A small, glossy, narrow, cylindrical shell with straight parallel sides. Whorls  $6\frac{1}{2}$ , not very convex, last 4 almost equal, first  $1\frac{1}{4}$  smooth, remainder sculptured with close, fairly strong, slightly oblique transverse striae, which become farther apart on the penultimate whorl and very weak about periphery of the last. Aperture quadrate, peristome reflexed, dentition 7-fold: a strong curved angular lamella; a large labral base, bearing 3 cusps, of which the 2 upper, near the surface, are small and contiguous and the lowest deep-set and larger; a blunt denticle on left centre of base; a small tubercle half-way up the columellar margin and a large square deep-set fold at upper angle of the columella.

Long. 5.2, lat. 1.8; apert. alt. 0.7, lat. 0.7; last whorl 2.7 mm.

Hab. ZULULAND. Mfongosi District (Jones).

Type in South African Museum.

A pillar-shaped little shell, distinguishable by the 3-fold labral process, plus the columellar tubercle.

Group 15. Dentition roughly 6-fold, the 2 upper labral teeth forming a large polymorphic slab.

(i) More or less strongly striate.

Gulella adamsiana (Pfr.).

(Text-fig. 5.)

Ref. List Nos. 7, 97.

?1856. Helix fanulus Pfr., P.Z.S., p. 33. D.

1859. Ennea adamsiana Pfr., Novit. Conch., i, p. 114, pl. xxxii, f. 9-11. D.F.

1893. Ennea socratica M. & P., A.M.N.H., xii, p. 109, pl. iii, f. 14. D.F.

1932. Gulella adamsiana Pfr. (= socratica M. & P.), Conn., Ann. Natal Mus., vii, p. 74.  $\,N$ .

1933. Gulella adamsiana Pfr., Warren, Ann. Natal Mus., vii, p. 295. N.

Shell of fair size, cylindriform, silky. Sides parallel, straight or somewhat convex, summit, 4 whorls, bluntly conoid. Whorls 8, little convex, last 4 increasing very slowly in height, protoconch,  $2\frac{1}{2}$  whorls, sculptured almost to extreme apex with extremely close and fine transverse microscopic striolae, remainder with close, regular, nearly straight, oblique costulae; suture subcrenulate. Aperture quadrate, base little rounded, dentition 6-fold: a strong, short, oblique angular lamella; a long low labral base, corresponding to a large horizontal external pit, its upper portion bearing a large oblique slab, entering deeply and increasing in size downwards from the sinus and terminating in a strong acute cusp, which is half separated from the rest by a small depression; the lower part bearing, at base of labrum, a strong blunt denticle unconnected with the upper process; a large pointed denticle

occupying left half of base; a strong, rather elongate tubercle on inner columellar margin and a large immersed columellar lamella, with a strong ridge from its base to apex, and deeply hollowed between that and its lower margin, which terminates almost horizontally in the columellar wall at a deeper level than the superficial process. The type measures

Long. 8.5, lat. 4.0; apert. alt. 2.0, lat. 1.6; last whorl 4.3 mm.

Hab. NATAL. Port Natal (adamsiana and fanulus, fide Pfeiffer): Pietermaritzburg (socratica); generally distributed.

CAPE PROVINCE. Port St. John's (Puzey); "said to be found at Korsten, Port Elizabeth" (Crawford).

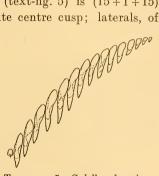
All types in British Museum.

Radula formula in specimen figured (text-fig. 5) is (15+1+15) $\times 60 + n$ ; central very small with minute centre cusp; laterals, of

which the bases are longer than the points, increase in size to No. 6 and then decrease to No. 10, which is about same size as No. 1; remainder decrease more rapidly, No. 15 being rudimentary.

The shell varies considerably in size in different localities, the smallest I have seen from Maritzburg being  $6.8 \times 3.4$ , and a large fusiform example from Port St. John's  $10 \times 4.7$  mm.

H. fanulus is unquestionably the top of either this species or its var.



Text-fig. 5—Gulella adamsiana (Pfr.), Pietermaritzburg. Half row of teeth of radula;  $\times 200$  approximately.

impervia, and purists may claim for it nomenclatural precedence; the fact, however, that it is impossible to determine its exact specific or varietal status may render it advisable to retain the present names.

Warren records an abnormal family, collected on two occasions under one end of an old felled Eucalyptus, while at the other end normal specimens occurred. They are longer, with about  $9\frac{1}{4}$  whorls, the aperture being thrown to the right in basal aspect, so that the umbilicus is left open instead of being occluded.

> var. impervia M. & P. Ref. List No. 7.

1896. Ennea impervia M. & P., A.M.N.H., xviii, p. 315, pl. xvi, f. 1. D.F.

Stouter than type with stronger dentition, the lower labral squarer and basal much larger, obliquely truncate rather than bluntly pointed, extending some way up the columella. These features, however, vary so much in strength in different races that they cannot be relied on for distinction, but in the typical form of the variety the lower margin of the columellar lamella curls outwards and upwards nearly to the surface, where it connects with the upper end of the marginal process, instead of terminating at a deeper level, lower down the columella.

Long. 8.7, lat. 4.2; apert. alt. 2.2, lat. 1.9; last whorl 4.7 mm.

Hab. NATAL (type, fide M. & P.); Lower Umkomaas (Burnup); other localities formerly assigned to the variety have not been verified.

Type in British Museum.

# Gulella auris-leporis (M. & P.).

Ref. List No. 12.

1898. Ennea auris-leporis M. & P., A.M.N.H., i, p. 25, pl. viii, f. 3. D.F.

Founded on a single example, not in very good condition, which may account for the sculpture appearing weaker than that of adamsiana, which it resembles in nearly every respect except for being more ventricose, greatest diameter at the penultimate (6th) whorl and tapering thence in both directions. The aperture is more constricted and the base of the basal tooth stretches half-way up the columella and bears a distinct upper and hardly noticeable lower cusp. There are 7 flattish whorls, the type measuring

Long. 6.5, lat. 3.4; apert. alt. 1.35, lat. 1.2; last whorl 3.7 mm.

Hab. NATAL (fide M. & P.).

Type in British Museum.

In view of the variation in form and dentition to be found in other Natalian species, it would take little to unite the above with the adamsiana-impervia group, of which it may be a deformed example.

## Gulella wahlbergi (Krs.). Ref. List Nos. 101, 106.

1848. Pupa wahlbergi Krs., Südafr. Moll., p. 80, pl. v, f. 5. D.F.

1898. Ennea transiens Stur., S.A. Moll., p. 19, pl. i, f. 4. D.F.

1914. ,<br/>, wahlbergi Krs., Dautz. & Germ., Rev. Zool. Afr., iv, p. 11. <br/> L.

1920. Ennea (Gulella) wahlbergi Krs., Germ., Voy. Babault, p. 67. D.

1925. Gulella wahlbergi Krs. (=transiens Stur.), Bnp., Ann. Natal Mus., v, p. 127, pl. viii, f. 35. N.F.

1925. Gulella wahlbergi Krs. (=transiens Stur.), Conn., Trans. R. Soc. S. Africa, xii, p. 120. N.L.

Shell of fair size, subcylindriform, silky. Sides regular, slightly convex, summit,  $4\frac{1}{2}$  whorls, bluntly conoid. Whorls  $7\frac{1}{2}$ –8, nearly flat, first 2 sculptured as in adamsiana with extremely fine and close transverse microscopic striolae, remainder with

close, regular, nearly straight, oblique costulae; suture well defined. Aperture quadrate, base little rounded, dentition 6-fold: a strong, short, oblique angular lamella; a large labral base with deep external pit, the upper portion forming a triangular slab, upper edge more or less parallel to the angular lamella, usually bearing a small denticle at its lower and a slight angular swelling at its upper extremity, the lower portion bearing a small pointed denticle; a narrow denticle on extreme left of base; a clear triangular tubercle half-way up the columellar margin and a deep-set columellar lamella, similar to that of adamsiana, with a deep well at

Long. 10.4, lat. 5.0; apert. alt. (intern.) 2.4, lat. 2.0; last whorl 6.0 mm.

Hab. NATAL (type, Wahlberg); Durban and neighbourhood; Isipingo (transiens, Penther).

Type of wahlbergi in Stuttgart, transiens in Vienna Museum.

Krauss mentions two specimens in his description, of which one was smooth, except on the last whorl, with no process on the columellar margin, and the other costate all over, with a marginal tooth; the latter, which agrees with his figure in sculpture and columellar dentition, is doubtless the type, but the fact of his having the other shell before him may account for some of the discrepancies between his delineation and the actual species, which is common in the Durban district. It varies slightly in breadth in accordance with the convexity of its sides; though resembling closely some forms of adamsiana, it may be readily distinguished by the less obstructed aperture, the labral and basal processes being weaker than in Pfeiffer's species.

### (ii) Practically smooth.

## Gulella formosa (M. & P.). Ref. List No. 74.

1898. Ennea formosa M. & P., A.M.N.H., ii, p. 126, pl. vii, f. 3. D.F.

Shell resembles adamsiana in form, cylindriform, smooth and glossy. Whorls 8, nearly flat, protoconch (2½ whorls) sculptured as in adamsiana with close, fine microscopic transverse striolae, remainder only with short, oblique infrasutural striae, usually absent from the remaining surface until reappearing around the perforation. Dentition as in adamsiana, except that the upper labral process enters less deeply and is more noticeably bicuspid, the lower cusp usually strong and upper often lacking, and the basal tooth usually more triangular; the columellar lamella is exactly similar to that of adamsiana.

Long. 8.0, lat. 3.8; apert. alt. 1.8, lat. 1.5; last whorl 4.2 mm.

Hab. NATAL. Durban (type, Quekett, fide M. & P.); Pietermaritzburg (Burnup); Karkloof (Taynton); Riet Vlei (Pennington); Cathkin Peak, Drakensberg (Falcon); Hilton Road (Puzey).

Type in British Museum.

Some doubt exists as to the correctness of the type-locality; the smallest shell recorded is  $6.0 \times 2.5$  mm.

Gulella infrendens (Mts.). Ref. List Nos. 23, 46, 54.

1866. *Pupa (Ennea) infrendens* Mts., Mal. Blätt., xiii, p. 110, pl. iii, f. 10-12. *D.F.* 

1901. Ennea foriclusa M. & P., A.M.N.H., viii, p. 316, pl. ii, f. 3. D.F.

1903. Ennea claustraria M. & P., A.M.N.H., xii, p. 597, pl. xxxi, f. 16. D.F.

1907. Ennea stauroma M. & P., A.M.N.H., xix, p. 96, pl. vi, f. 4. D.F.

1932. Gulella infrendens Mts. (=foriclusa and claustraria M. & P.), Conn., Ann. Natal Mus., vii, p. 75. N.

Shell smooth and glossy, entirely similar in form to adamsiana. Whorls 8, nearly flat, practically sculptureless, suture shallow, with margined appearance. Dentition as in adamsiana, except that the sides of angular lamella and upper labral run even more closely together and the basal process is larger and rounder, situate more to the left, on the columella, touching the strong round marginal tubercle; columellar lamella deeply furrowed down the centre, as in adamsiana, and the lower fold does not approach the marginal process. The type was said to be  $7.0 \times 3.5$  mm.; a Krantzkop example measures

Long. 7.9, lat. 3.6; apert. alt. 1.3, lat. 1.8; last whorl 4.1 mm., and the size varies from about  $7 \times 3\frac{1}{2}$  to  $8\frac{3}{4} \times 4$  mm.

Hab. NATAL (type, Queinzius); common in the southern districts; Table Mountain (foriclusa, Burnup).

ZULULAND. Lower Umfolosi Drift (claustraria); Eshowe (Burnup); Melmoth (stauroma, Miss Hickey); Mfongosi (Jones); St. Lucia Bay; Hluhluwe Game Reserve (Rump).

Type of infrendens ubi? claustraria, foriclusa, and stauroma in British Museum.

These so-called species were founded on almost negligible differences in size and strength of dentition, and have been shown to merge into one another without justification for varietal distinction.

Gulella daedalea (M. & P.). Ref. List No. 33.

1903. Ennea daedalea M. & P., A.M.N.H., xii, p. 598, pl. xxxi, f. 12. D.F.

Extremely near the foregoing, from which it may be separable by slightly weaker dentition, the basal tooth, in particular, being more pointed and situate on left

centre of base, rather than infringing on the columellar margin. There are 8 flattened whorls, entirely destitute of sculpture, a typical example measuring Long. 7.8, lat. 3.6; apert. alt. 1.3, lat. 1.6; last whorl 3.9 mm.

Hab. ZULULAND. Lower Umfolosi Drift (type, Burnup); Mfongosi (Jones).

Type in British Museum.

Group 16. Dentition 7-fold, 2 distinct denticles on labrum and 1 in sinus.

(i) More or less strongly striate.

### Gulella regularis (M. & P.). Ref. List No. 93.

1893. Ennea regularis M. & P., A.M.N.H., xi, p. 22, pl. iii, f. 11. D.F.

1926. Gulella regularis M. & P., Bnp., Ann. Natal Mus., v, p. 388. D.

Shell of fair size, cylindrical, dull and silky. Sides of spire nearly straight, summit obtusely rounded. Whorls 6, nearly flat, first 1½, where not weathered, showing patches of close, fine, regular, microspiral engraving, remainder sculptured with close, regular, slightly curved and oblique costulae; suture simple, shallow. Aperture subtrigonal, dentition 7-fold: a strong oblique angular lamella; a very minute denticle high on the sinus; 2 sharp labral denticles, the lower the stronger, corresponding to a single external pit; another on left centre of base; a tuberculate swelling near top of columellar margin and a strong, blunt, ridged columellar lamella. A Maritzburg example measures

Long. 7.1, lat. 3.2; apert. alt. 1.3, lat. 1.2; last whorl 3.9 mm.

Hab. NATAL. Pietermaritzburg (type); Albert Falls (Burnup); Impolweni (Puzey); Howick (Cregoe).

Type in British Museum.

A well-named species, most regular in form and dentition.

## Gulella dunkeri (Pfr.). Ref. List Nos. 40, 103.

1855. Ennea dunkeri Pfr., Mal. Blätt., ii, p. 173. D.

1893. vandenbroeckii M. & P., A.M.N.H., xii, p. 110, pl. iii, f. 16. D.F.

1898. Ennea differens Stur., S.A. Moll., p. 20, pl. i, f. 5-6. D.F.

1932. Gulella dunkeri Pfr. (= vandenbroeckii M. & P.), Conn., Ann. Natal Mus., vii, p. 73, pl. iv, f. 6-9. D.F.

Differs from the foregoing in more fusiform contour, the sides of spire being usually slightly convex, summit higher and more acute and aperture proportionately narrower, while the whorls increase more slowly, there being more in equal length; typical Natal examples contain from 8 to 9 nearly flat whorls, first 2½ smooth, remainder sculptured with strong, close, regular, nearly straight, oblique costae. Aperture nearly oblong, rounded at base, labium straight and vertical, thus narrowing it on the left side; dentition 7-fold, as in *regularis*, sinular denticle usually strong, labrals arising from a low base, lower long and thick, upper short and pointed; basal and columellar processes as in *regularis*. A rather small but typical example measures

Long. 7.2, lat. 3.6; apert. alt. 1.2, lat. 1.3; last whorl 4.0 mm., but the size of normal shells from the Durban district ranges up to  $9.2 \times 4.3$ , with a single attenuated example  $9.4 \times 3.9$  mm. in length and breadth; the smaller races will be

discussed hereunder.

Hab. NATAL (vandenbroeckii, ex coll. Vandenbroeck); Port Natal (dunkeri, Plant); Durban (differens, Penther), and widely distributed throughout the Durban district; Tyeloti; Pinetown; Table Mountain; Lower Umkomass; Untunjambili, near Krantzkop (Burnup); Krantzkop (Warren); Umvoti Poort (Hamilton).

ZULULAND. Mfongosi (small race, Jones).

Type of dunkeri in Stettin, differens in Vienna, and vandenbroeckii in British Museum.

This species, while remaining very constant in dentition, varies considerably in size and contour from different localities; some local races are much smaller than type, that from Table Mountain measuring about  $6.2 \times 3.35$  and that from Krantzkop  $5.9 \times 3.0$  mm. in length and breadth, while that from Mfongosi is still smaller, and usually of more obese contour; sinular and marginal columellar processes comparatively smaller than in type. Length varies from 4.9 to 5.8, breadth about 3.0, last whorl 3.0 to 3.2 mm.

Group 17. Process on centre of paries.

(i) Striate.

Gulella mfongosiensis Bnp.

1925. Gulella mfongosiensis Bnp., Ann. Natal Mus., v, p. 146, pl. ix, f. 52–54. D.F.

Shell very small, cylindrical, silky. Sides straight and parallel, summit, 2 whorls, obtusely mamillate. Whorls 6, very convex, first 2 smooth, remainder sculptured with regular, fairly close, straight vertical costulae; suture deep. Aperture quadrate, dentition 9-fold; a small tubercle on centre of paries; a strong angular lamella; a large labral tooth with blunt rounded end and a denticle on its upper edge; a sharp denticle on left centre of base, and 3 minute, deep-set contiguous tubercles between it and the labral process; a small tubercle half-way up the columella, and a large, deep-set, convex columellar lamella. The type is a small example measuring

Long. 3.07, lat. 1.52; last whorl 1.76 mm., but the species varies in length from

2.9 with  $5\frac{3}{4}$ , to 4.8 mm. with 7 whorls.

Hab. ZULULAND. Mfongosi (type, Jones).

NATAL. Bushman's R. Falls, Weenen (Thomasset).

Type in British Museum.

Notwithstanding their minuteness the 3 tubercles on right of base and that on paries render this species easily recognisable.

(ii) Practically smooth.

Gulella puzeyi sp. n. (Pl. i, f. 8.)

Shell of moderate size, rimate, cylindrical, smooth, glossy, pale olivaceous. Spire produced, sides flat and parallel, apex rounded. Whorls 7, nearly flat, last 3 equal in breadth, smooth except for extremely weak, oblique microscopic striolae, visible just beneath and in the sutures of the last 2; suture shallow. Aperture quadrate, dentition normally 9-fold; a strong, oblique angular lamella; a large triangular mound, corresponding to an external pit, occupying nearly the entire labrum, with a small cusp on the upper side; a small tubercle deep-set under it, not discernible from a frontal view; a strong mid-basal denticle; a flattened tubercle half-way up the columella, with a smaller one, more inset, immediately above it; a huge, club-like columellar lamella with a deep well at its base, and a flat horizontal bar, parallel to and extending nearly across the paries.

Long. 6.9, lat. 3.0; apert. alt. 2.3, lat. 1.7; last whorl 3.8 mm.

Hab. CAPE PROVINCE. Port St. John's (Puzey).

Type in British Museum.

Apart from other unusual features, the long, flat parietal bar distinguishes this species from any other known to me; I have greatest pleasure in naming it after its discoverer, whose recent acquisitions have been of so great value in the elucidation of geographical distribution in the present work.

Group 18. Labral process 1 large polymorphic slab; other processes variable.

(i) More or less strongly sculptured.

Gulella crassidens (Pfr.). Ref. List Nos. 27, 95.

1859. Ennea crassidens Pfr., Novit. Conch., i, p. 114, pl. xxxii, f. 6-8. D.F.

1892. Ennea scrobiculata M. & P., A.M.N.H., ix, p. 93, pl. vi, f. 8. D.F.

1898. Ennea durbanensis Stur., S.A. Moll., p. 25, pl. i, f. 17. D.F. 1932. Gulella crassidens Pfr. (=scrobiculata M. & P.), Conn., Ann. Natal Mus., vii, p. 77. N.

Shell rather small, acuminate elliptical, silky. Sides somewhat convex, tapering from the penultimate whorl upwards in a gentle curve to an obtuse apex. Whorls  $8\frac{1}{2}$ , nearly flat, widest at the 7th, the last narrowing downward, first 2 smooth, remainder sculptured with close, regular, strong, slightly curved, oblique costulae;

suture well defined. Aperture subtrigonal, somewhat constricted, rounded at base, dentition 6-fold; a strong, slightly oblique angular lamella; a minute denticle near top of sinus, obscured from frontal view by the lamella; a very large oblong labral slab, with a deep horizontal external pit, nearly flat or somewhat bilobed, and usually bearing a most minute denticle at its uppermost extremity; a small denticle just to left centre of base; a low swelling, sometimes hardly visible, on columellar margin and a large, blunt, inset columellar lamella; an average Durban example measures

Long. 5·3, lat. 2·9; apert. alt. (intern.) 1·2, lat. 0·8; last whorl 2·7, and another with 9 whorls: long. 5·7, lat. 2·9 mm.

Hab. NATAL (scrobiculata, Layard); Port Natal (crassidens, Plant); Durban; Isipingo (durbanensis, Penther); Pinetown; Equeefa (Burnup); Stanger; Sinkwazi (Pennington); Hilton (Falcon); Illovo R. (Taynton).

ZULULAND. Mfongosi (Jones).

Types of crassidens and scrobiculata in British, durbanensis in Vienna Museum.

The Zulu race are smaller, with much more convex whorls, usually straight sides, and lack the sinular denticle; an example with  $8\frac{1}{4}$  whorls measures: long. 4.25, lat. 1.9; last whorl 2.2 mm., the smallest examined being only  $3.8 \times 1.8$  mm.

#### Gulella contingens Bnp.

1925. Gulella contingens Bnp., Ann. Natal Mus., v, p. 152, pl. ix, f. 57-60. D.F.

Shell of similar pattern to the foregoing, but of fusiform contour and far more constricted towards base. Whorls  $9\frac{1}{2}$ , somewhat convex, first 3 smooth, remainder strongly obliquely costulate as in crassidens, except near the base, where the striae are fine and weak; suture rather deep. Aperture constricted, elongate, subtrigonal, narrowly rounded at base, somewhat inclined downward to the left; dentition 5-fold; a short, oblique angular lamella; a minute denticle at top of sinus, hidden from frontal view by the lamella; a long flattish slab occupying nearly the entire labrum, with a minute denticle on its upper edge which touches that of the lamella, forming with the sinulus a complete circle; a deep-set denticle on left of base and a deep-set scoop-shaped columellar lamella, of which the lower rim curves upwards towards the surface and then backwards towards the paries, giving it a duplex appearance. The type measures

Long. 5·7, lat. 2·9; apert. alt. (intern.) 1·4, lat. 1·1; last whorl 2·7 mm., while the length varies from 5·4 to 6·2 mm.

Hab. NATAL. Zimbaba Bush (type), Untunjambili, and Amanhlati Valley, Krantzkop (Warren, Burnup, and Falcon).

Type in British Museum.

Although the columellar process is in reality single, its duplex appearance, together with the fusiform contour and much constricted aperture of the shell, seem to justify its inclusion next to crassidens in the present group.

Gulella harriesi Bnp.

1926. Gulella harriesi Bnp., Ann. Natal Mus., v, p. 391, pl. xxi, f. 34-35. D.F.

Shell small, cylindriform, silky. Sides slightly convex, summit, 4 whorls, convex-conoid. Whorls 8, little convex, first 21 smooth, remainder sculptured with close, regular, nearly straight, oblique costulae, weaker and closer behind the labrum; suture well defined. Aperture quadrate, rounded at base, dentition 6-fold; a large squarish angular lamella; a massive labral slab with a large triangular external pit, and bearing usually from 1 to 4 minute cusps or tubercles on its upper and outer edges; a minute denticle below it on right of base; a denticle at bottom, and another, stronger, above middle of columella, and a large, blunt, convex columellar lamella. The type measures

Long. 6.9, lat. 3.4; apert. alt. (intern.) 1.3, lat. 1.1; last whorl 3.4 mm., and the shell ranges from 6.0 to 6.9 × 3.3 to 3.45 mm. in length and breadth; no armature

has been observed in young shells.

Hab. TRANSVAAL. Pepiti Falls, Sibasa (Harries). Type in British Museum.

> Gulella munita (M. & P.). Ref. List No. 73.

1892. Ennea munita M. & P., A.M.N.H., ix, p. 86, pl. vi, f. 5. D.F.

1914. Ennea munita M. & P. Bnp., Ann. Natal Mus., iii, p. 52, pl. iv, f. 38. D.F.

Shell small, cylindrical, with bluntly rounded summit of 3 whorls. Whorls 7, flattish, last 5 sculptured with close, regular, nearly straight costulae, oblique on 4 and vertical on the last whorl, which is smooth in front; suture well defined. Aperture contracted oblong, narrowly rounded at base, dentition 5-fold; an almost vertical angular lamella; a long labral slab with 2 blunt cusps, the lower much the larger, corresponding to a deep external well; a rather blunt denticle slightly to the right centre of the base; a deep-set, rounded columellar lamella and a low marginal ridge, extending and widening from the base upward to nearly the top of the columella, where it ends abruptly to form a low triangle.

Long. 3.9, lat. 1.7; last whorl 2.25 mm.

Hab. CAPE PROVINCE. Griqualand East (type, coll. Sykes); Kowie (Ponsonby & Langley).

Type in British Museum.

The Kowie race is larger than type, ranging from  $4.3 \times 2.1$  up to  $4.9 \times 2.2$  mm.

Gulella tharfieldensis (M. & P.).

Ref. List Nos. 63 and 99.

1893. Ennea tharfieldensis M. & P., A.M.N.H., xii, p. 109, pl. iii, f. 15. D.F.

1898. Ennea leppani Stur., S.A. Moll., p. 28, pl. ii, f. 23-25. D.F.

1932. Gulella tharfieldensis M. & P. (=leppani Stur.) Conn., Ann. Natal Mus., vii, p. 76.  $\,N.$ 

Differs chiefly from the foregoing in the shape of the labral slab, which is usually weakly tricuspid, a strong median and two inconspicuous cusps at the upper and lower extremities, with a single external pit; the superficial slab on the columella is flatter, not angulate at the top, and there is usually a minute denticle on left of paries, near the columellar angle. The type contains  $7\frac{1}{2}$  whorls and measures  $5\cdot0\times2\cdot25$  mm.

Hab. CAPE PROVINCE. Tharfield (type, Miss Bowker); Kowie (Farquhar); Port Alfred District (Puzey); Great Fish R. (J. L. B. Smith); Albany District (leppani, Penther).

Type of tharfieldensis in British, leppani in Vienna Museum.

While the normal dentition includes a small parietal denticle, this process was lacking in the type and two paratypes available of *leppani*, which is in all other respects identical with M. & P.'s species, and I showed in 1932 that in most series from various localities its presence or absence is of no consequence, since both forms usually occur in company; Sturany's name can of course be retained, if desired, as varietal for the form that lacks the denticle.

#### Gulella craterodon (M. & P.). Ref. List No. 29.

1903. Ennea craterodon M. & P., A.M.N.H., xii, p. 597, pl. xxxi, f. 9. D.F.

A narrow cylindrical shell with straight sides and bluntly conical apex of  $4\frac{1}{2}$  whorls. Whorls  $9\frac{1}{2}$ , almost flat, last 5 scarcely increasing, sculptured after the first 2 with strong, close, regular, nearly straight, very oblique costulae. Aperture long and narrow, dentition 4- or 5-fold; a nearly vertical angular lamella; an oblong slab, with a deep external pit, occupying half the labrum, with a point at each extremity; a flattish, deep-set columellar lamella and a rather long, rounded tubercle, partially concealing it, near the top of columellar margin.

Long. 8.2, lat. 3.2; apert. alt. 1.2, lat. 1.1; last whorl 4.0 mm.

Hab. CAPE PROVINCE. Maestrom Forest, Bedford (type, Farquhar).

Type in British Museum.

Differs from others of this group in absence of basal denticle.

### (ii) Practically smooth.

### Gulella rumpiana Conn.

1932. Gulella rumpiana Conn., Ann. Natal Mus., vii, p. 88, pl. iv, f. 18. D.F.

A small, cylindrical, smooth, glossy shell with parallel sides and bluntly rounded summit. Six whorls, the faint oblique sculpture hardly visible except for 7 or

8 strong vertical striae just behind the outer lip. Dentition 5-fold, arranged as in tharfieldensis except for lacking the parietal denticle, but differing eonsiderably in form of the labral and columellar processes, the latter being a strong oblong superficial slab and the former best developed at its lower end, whence the left side slopes upwards in almost a straight line until forming a minute cusp and a blunt angle before joining the labrum; basal denticle and columellar lamella as in the group.

Long. 5.5, lat. 2.3; last whorl 2.8 mm.

Hab. NATAL. Margate (Rump). Type in British Museum.

(ii, a) Minutiae.

Gulella farguhari (M. & P.). Ref. List Nos. 45, 52, 62, 69, 77, 81.

1895. Ennea farguhari M. & P., A.M.N.H., xvi, p. 478, pl. xviii, f. 3-5. D.F.

1895. Ennea labyrinthea M. & P., A.M.N.H., xvi, p. 479, pl. xviii, f. 7-8. D.F.

1899. Ennea microthauma M. & P., A.M.N.H., iv, p. 194, pl. iii, f. 1. D.F.

1909. Ennea hypsoma M. & P., A.M.N.H., iv, p. 488, pl. viii, f. 7. D.F.

1909. Ennea oppugnans M. & P., A.M.N.H., iv, p. 488, pl. viii, f. 8. D.F.

1909. Ennea periploca M. & P., A.M.N.H., iv, p. 489, pl. viii, f. 10. D.F.

1914. Ennea fargulari (=labyrinthea, microthauma, hypsoma, oppugnans, and periploca) M. & P., Bnp., Ann. Natal Mus., iii, p. 41, pl. iv, f. 24. D.F.

1925. Gulella farguhari M. & P., Conn., Trans. R. Soc. S. Africa, xii, p. 119. N.L.

Shell minute, shortly cylindrical, smooth and glossy. Sides straight and parallel, summit,  $2\frac{1}{2}$  whorls, round. Whorls  $5\frac{1}{2}$ , moderately convex, first 2 smooth, next nearly so, remainder sculptured with regular, comparatively distant, nearly straight and vertical striae, strong below the suture and more or less evanescent lower down, except on the last whorl, where they continue round the base; suture subcrenulate. Aperture quadrate, rounded at base, dentition 5-fold: an oblique angular lamella; a large triangular or oblong labral slab, usually more or less bilobed; a small denticle in centre of base; a low swelling on columellar margin and a deep-set rounded columellar lamella; the paratype figured by Burnup measures

Long. 2·11, lat. 1·03; last whorl 1·15 mm.; while dimensions given by that author range from  $3.19 \times 1.36$  down to  $2.06 \times 1.03$  mm.

Hab. CAPE PROVINCE. Grahamstown (fargulari and labyrinthea, Farguhar; microthauma, Langley); Trappes Valley, Bathurst (hypsoma and oppugnans); Highlands (Farquhar); Katherg Forest; Kowie East, Port Alfred (Hewitt).

LORENZO MARQUES. Mt. Vengo, Macequece (Cressy).

All types in British Museum.

The Macequece race is smoother than type, with the labral tooth usually more pointed, and less inclined to bifurcation.

#### var. berthae M. & P. Ref. List No. 13.

1901. Ennea berthae M. & P., A.M.N.H., i, p. 315, pl. ii, f. 1. D.F. 1914. Ennea farquhari, var. berthae M. & P., Bnp., Ann. Natal Mus., iii, p. 44, pl. iv, f. 25–27. D.F.

Differs from type in more elliptical contour; 6 less ventricose whorls and shallower suture, the striae rather less regular, shorter and farther apart; labral tooth not quite so massive, and less divided, columellar lamella somewhat broader and marginal columellar process weaker; the paratype figured by Burnup measures Long. 2.84, lat. 1.5; last whorl 1.6 mm.

Hab. NATAL. Karkloof Bush (type, McBean; Taynton); Nottingham Road (Taynton); Ntimbankulu (Burnup).

CAPE PROVINCE. East London (Kincaid).

Type in British Museum.

The length varies from about 2.8 to 3.3 mm.

#### var. avena Bnp.

1914. Ennea farquhari M. & P., var. avena Bnp., Ann. Natal Mus., iii, p. 46, pl. iv, f. 28-31. D.F.

Differs from type in more cylindrical form with nearly parallel sides, less ventricose whorls, shallower suture, absence of defined sculpture except on last half-whorl, more open aperture with more superficial, undivided labral process and less developed shelf on columellar margin, exposing more of the columellar lamella; separable from var. berthae by more slender, cylindrical form, more open aperture, absence or extreme shortness of infrasutural sculpture, and solid, nearly superficial labral tooth. The type, with  $6\frac{1}{4}$  nearly flat whorls, measures

Long. 3·2, lat. 1·3; last whorl 1·6 mm.; extremes range from 2·74 to 3·51 mm.

in length, and number of whorls from  $5\frac{1}{2}$  to 7.

Hab. NATAL. Pietermaritzburg (type); Pinetown; Durban (Burnup); Sinkwazi (Puzey); Nottingham Road (Taynton).

ZULULAND. Mfongosi (Jones).

Type in British Museum.

#### Gulella chi Bnp.

1926. *Gulella chi* Bnp., Ann. Natal Mus., v, p. 394, pl. xxi, f. 36–39. *D.F.* 

Shell minute, cylindrical, smooth and glossy. Sides parallel, summit, 2¼ whorls-rounded. Whorls 5¼, first 2 smooth, remainder sculptured with very weak, close, regular, nearly straight and vertical striolae; suture shallow. Aperture suboval, dentition 5-fold: a strong, short angular lamella; a large, broad, scarcely lobed labral tooth with small external pit; a small basal denticle; a large square tooth on upper margin of columella, almost hiding the deep-set columellar lamella. The type measures

Long. 2.43, lat. 1.17; last whorl 1.3 mm.

Hab. CAPE PROVINCE. East London (type, Kincaid); Great Fish R., 20 miles east of Kowie (Smith); Trappes Valley, Bathurst (Farquhar).

Type in British Museum.

Group 19. With additional immersed slab under the usual labral process.

#### Gulella contraria (Conn.).

1932. Gulella contraria Conn., Ann. Natal Mus., vii, p. 88, pl. iv, f. 17. D.F.

Shell very small, shortly cylindrical, smooth and glossy. Sides parallel, summit,  $3\frac{1}{2}$  whorls, convex-conoid. Whorls  $7\frac{1}{2}$ , nearly flat, practically sculptureless; suture shallow. Aperture oblong, narrowing at base, dentition 5-fold: a strong curved angular lamella; a long flattish plate near labral margin, usually with a short acute denticle at its upper end, corresponding to a deep external pit; a broad square slab, deep-set within the labral margin, parallel to this plate; a small, comparatively deep-set denticle at centre of base, and another broad, nearly square slab on columella.

Long. 4.7, lat. 2.2; apert. alt. 0.9, lat. 0.75; last whorl 2.6 mm.

Hab. NATAL. Vryheid (Puzey).

Type in British Museum.

The duplex labral process distinguishes this species from nearly all other African Gulellae.

#### FAMILY PARYPHANTIDAE

(=Rhytididae).

The classification of this family and anatomical notes, in so far as concerns its African members, are based on Watson's recent revision.

Shell heliciform, umbilicate, corneous, rounded at periphery, peristome thin or somewhat thickened, but not expanded or reflexed.

Foot of animal without peripodial grooves or caudal mucous pore; kidney about  $1\frac{1}{2}$  times to twice the length of the pericardium, but vol. XXXIII.

not extending up towards the rectum at its posterior end. Ureter passing back along the upper edge of the kidney and opening above its hinder end. Pedal gland well developed and exposed on the floor of the body cavity; central nervous system surrounding the anterior part of the buccal mass, cerebral commissure short, cerebro-pedal and cerebro-pleural connectives long, and the pedal, pleural, and visceral ganglia closely aggregated, though they can be distinguished from one another.

Reproductive system with no well-developed vesicula seminalis, epiphallic flagella, nor dart-glands; penis bearing numerous small papillae, but when retracted it contains no penis-papilla or glands.

Jaw absent; radula long, but with less than 100 transverse rows of teeth, all of which are unicuspid and some of them often extremely large.

Genus Nata Watson, 1934 (Proc. Mal. Soc., xxi, p. 158). Type Natalina tarachodes Conn.

Shell depressed globose, very glossy, corneous amber, protoconch small, about 2 whorls without radial ribs; umbilicus usually wide.

Genital opening far back on right below mantle-edge; left body lobes quite separate, with relatively short attachments to the mantleedge, and projecting outer angles; front end of kidney bent outwards and backwards, so that beginning of ureter overlaps anterior end of pericardium. Spermoviduct not convoluted, apart from the folding of the wall of the female portion; duct of spermatheca broad anteriorly and of moderate length, considerably shorter than in Natalina. Free oviduct rather long and narrow, without appendiculum. Vagina very short, with appendix in N. tarachodes only; penis shorter and broader than in Natalina; epiphallus, when present, comparatively small and much narrower than penis. Retractor of right upper tentacle passing to left of penis and not between it and vagina. Radula with fewer teeth than usual, there being about 26-45 rows, and between 20 and 30 teeth in each in hitherto described species, showing, even in adult examples, a marked increase in size when followed backwards from the front to hinder end of the radula, while when followed outwards they increase in size and then become smaller again towards the edges of the radula, but are not differentiated into laterals and marginals. Their shape is more or less conical, with straight or slightly curved pointed cusps, and somewhat triangular bases.

#### Section Nata s.s.

Radula without central tooth. Kidney approximately triangular, bluntly pointed in front; vas deferens passing forwards beside free oviduct and vagina and then backwards beside the penis, where it nearly always becomes more or less enlarged to form an epiphallus, which enters the penis laterally either at its hinder end or further forward.

> Nata vernicosa (Krs.). (Pl. iv, f. 4-5, and text-fig. 6.) Ref. List Nos. 116, 117, 134.

1848. Helix vernicosa Krs., Südafr. Moll., p. 76, pl. iv, f. 23. D.F. 1892. Helix (Macrocyclis) caenotera M. & P., A.M.N.H., x, p. 238, pl. xiii, f. 2. D.F.

1894. Natalina chaplini M. & P., A.M.N.H., xiv, p. 91, pl. i, f. 3. D.F.

Shell of moderate size, depressed globose, widely umbilicate, thin, silky above and glossy beneath, transparent, corneous yellow, occasional growth lines being pale red. Spire rather flat, apex obtuse. Whorls 5, not very convex, rounded at periphery, regularly increasing, protoconch, nearly 2 whorls, smoothly malleate, remainder sculptured above with close, fine, fairly regular, curved transverse striae, which become coarser and weaker nearing the aperture after the 5th whorl, and there is some trace of extremely close, faint, microscopic spiral sculpture on the later whorls, more visible on the base, where the transverse striation is fainter; suture simple, well defined. Aperture oblong ovate, descending slightly at base, peristome simple, acute, labrum descending rather steeply from suture, receding in a gentle curve to the base; columella short, weak, concave, upper margin extremely weakly reflexed, not overhanging the wide and deep umbilicus.

Diam. maj. 17.0, min. 13.9; alt. 9.5; apert. alt. 8.2, lat. 7.1 mm.

Hab. NATAL (type, Wahlberg); Durban (Puzey); Pietermaritzburg; Port Shepstone; Howick; Van Reenen (Burnup); Umlahli (Rump).

ZULULAND. Dukuduku (Toppin); Hlabisa (Burnup).

CAPE PROVINCE. Tharfield (caenotera, Schönland); Kamachs, 5 miles west of Uitenhage (chaplini, Crawford); Grahamstown (Miss Glanville; Farquhar); Kowie and Port Alfred; Port Elizabeth (Crawford); Somerset East (Purcell; Miss Bowker); Pirie Mountain (Godfrey); Keurbooms R. Bush (Barnard).

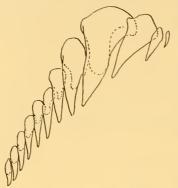
Type of vernicosa in Stuttgart, caenotera and chaplini in British Museum.

The types measure:

vernicosa: diam.  $14.8 \times 12.0$ ; alt. 7.6; apert. alt. 6.4, lat. 6.3 mm.

caenotera: diam.  $16.5 \times 14.0$ ; alt. 8.8; apert. alt. 8.4, lat. 7.9 mm.

chaplini: diam.  $10.1 \times 8.4$ ; alt. 5.0; apert. alt. 4.9, lat. 4.1 mm. The shells of vernicosa and caenotera are quite inseparable, and



Dukuduku. Half row of teeth of radula;

chaplini is merely an immature example; the spire in the type is quite flat, but I have seen it nearly as flat in specimens from Grahamstown.

The radula figured, from Dukuduku, measures 12 mm. in length and about 1.5 in breadth; there are 26 complete rows with formula 3+9+0+9+3, though radulae with formula 3+8+0+8+3 are also met with. The laterals increase in size Text-fig. 6.—Nata vernicosa (Krs.), from No. 1 to No. 9, which is very large and prominent; the inner marginal is about the same size as

No. 8 lateral, the next is much smaller and the outermost minute.

Nata minor (Pfr.). (Pl. ii, f. 9-11.)

1853. Helix vernicosa Krs., var. minor Pfr., Mon. Hel., iii, p. 95. D. "var. β. Minor, costulis superficiei obsoletioribus" (Pfr., l.c.). Hab. NATAL (fide Pfeiffer). Type ubi?

Pfeiffer's words may well apply to an immature example of the next species, but there extends from the Cape Province to Delagoa a hitherto undetermined race, which may perhaps represent his variety. It differs from vernicosa solely in being very much smoother, the sculpture consisting of fine growth striolae instead of costulae; the shell is small, glossy, golden yellow. Spire little raised. Whorls 4, covered with the fine, close, microspiral lineation common to the genus, first 2 practically devoid of transverse sculpture, which is weak and somewhat irregular on 3rd until nearing the 4th, when it becomes close, regular, and almost crisp above, very much fainter beneath. Aperture 7-lunar, scarcely descending, columella short, erect, concave, without marginal reflexion, umbilicus rather narrow, nearly funicular, hardly exposing the earlier whorls.

Diam. maj. 7.9, min. 6.6; alt. 4.4; apert. alt. 4.2, lat. 3.4 mm.

Hab. NATAL (type, probably Wahlberg); Pinetown; Ntimbankulu (Burnup); Impolweni (Rump).

The shell described and figured is one of Wahlberg's original lot in the Stockholm Museum, but larger examples, apparently conspecific with it, from Pinetown are 9.5 and Impolweni 10.5 mm. in major diameter.

Nata liparoxantha (M. & P.). (Pl. iii, f. 4–6.) Ref. List No. 128.

1892. Helix (Macrocyclis) liparoxantha M. & P., A.M.N.H., x, p. 238, pl. xiii, f. 3. D.F.

The shell appears to attain slightly larger dimensions than *vernicosa*, and the transverse striation is very slightly weaker and less crisp, beyond which there is no difference between the two, which have often been mistaken for one another and may well be conspecific.

Diam. maj. (type) 18·3, min. 14·5; alt. 11·3; apert. alt. 9·0, lat. 7·9 mm.

Hab. NATAL. Pietermaritzburg (type); Pinetown; Table Mountain; Port Shepstone (Burnup).

ZULULAND. Hlabisa (Burnup).

CAPE PROVINCE. Transkei (Weisbecker).

Type in British Museum.

The radula is practically identical with that of *vernicosa*, formula 3+8+0+8+3; one specimen in the Gwatkin collection exhibits the following abnormalities: On one side the line of inner marginals consists of mere bases with no points; on the other side, laterals 3 and 4 have their two points united to a common base, while laterals 5 and 6 have separate bases, but a common point.

The localities recorded above for this species and those for *vernicosa* (=*caenotera*), together with the close resemblance of both shell and radula, show that they are practically inseparable and probably conspecific.

## Nata dumeticola (Bs.).

Ref. List No. 120.

1851. Helix dumeticola Bs., A.M.N.H., vii, p. 106. D.

1854. ,, ,, ,, Pfr., Conch. Cab., p. 390, pl. cxliii (1852), f. 16–18. D.F.

1934. Nata dumeticola Bs., Watson, Proc. Mal. Soc., xxi, p. 158, pl. xix, f. 9. R.

A smaller form than vernicosa, with rather crisper costulae on the upper surface; a large specimen in the British Museum is golden yellow and contains 4 whorls,

first  $1\frac{3}{4}$  smooth, remainder sculptured above with strong, close, curved transverse costulae, which become very faint on the polished base, where there are extremely faint, illusory traces of microscopic spiral sculpture.

Diam. maj. 11.5, min. 9.4; alt. 7.9; apert. alt. 5.0, lat. 4.1 mm.

Hab. CAPE PENINSULA. Generally distributed as far south as Simonstown, and probably beyond that limit; Robben Island (Fisk). Type in British Museum.

### Nata tarachodes (Conn.). Ref. List No. 132.

1912. Natalina tarachodes Conn., Ann. S.A. Mus., xi, p. 96, pl. ii, f. 4. D.F.R.

1931. Macrocycloides cosmia Pfr., Thiele, Handb. Syst. Weichtierk., p. 725. R.

1934. Nata tarachodes Conn., Watson, Proc. Mal. Soc., xxi, pp. 158, 161, pl. xix, f. 6-8. D.A.R.

Smoother and usually smaller than any of the foregoing species; spire nearly flat,  $4\frac{1}{2}$  whorls, first 2 smooth, remainder showing above at irregular intervals faint, curved growth wrinkles, which become straight on the base; no spiral ornamentation worthy of mention.

Diam. maj. (type) 8.0, min. 7.0; alt. 3.3; apert. alt. 3.2, lat. 3.7 mm.

Hab. CAPE PENINSULA (type, Connolly); generally distributed. CAPE PROVINCE. Houw Hoek (Connolly); Katherg (Cruden); Kasouga, Port Alfred (Hewitt); Lemoens Hoek Mts., Heidelberg; Riebeck Kasteel Mts., 2800 ft.; Wellington Mts., 1500 ft. (Barnard).

BASUTOLAND. Masite (Hewitt).

Type in British Museum.

Radula formula  $(12+0+12)\times 35$ .

This species is fairly plentiful in the Cape Peninsula with dimensions not exceeding those of the type, but larger shells, more than 10 mm. in diameter, sometimes occur, when it is exceedingly difficult to determine whether they are not identical with *N. minor* (Pfr.).

Section Natella Watson, 1934
(Proc. Mal. Soc., xxi, p. 160).

Type Helix (Patula) viridescens M. & P.

Radula with central tooth. Kidney approximately oval, broadly rounded in front. Vas deferens not reflexed in the usual manner and not enlarged to form an epiphallus, but passing directly forwards to the apex of the short and broad penis.

(Text-fig. 7.)

Ref. List No. 135.

1891. Helix (Patula) viridescens M. & P., A.M.N.H., viii, p. 238. D. 1892. ,, ,, ix, pl. iv, f. 1. F.

1934. Nata viridescens M. & P., Watson, Proc. Mal. Soc., xxi, p. 160. A.R.

Shell very small, spire little raised, corneous golden yellow. Whorls  $3\frac{3}{4}$ , protoconch,  $1\frac{1}{2}$  whorl, smooth, remainder sculptured all over with weak, irregular, slightly curved growth striae without spiral striolation; umbilicus wide and open. Diam. maj. (type) 4.5, min. 3.8; alt. 2.2; apert. alt. 1.5, lat. 2.2 mm.

Hab. TRANSVAAL. Pretoria (type, Farquhar; McBean; Connolly); Pepiti Falls, Sibasa (Harries).

NATAL. Dargle; Inhluzani; Mkolombe Mt., near Weenen (Burnup).

Type in British Museum.

By far the smallest of the genus. The radula figured, from Mkolombe, measures 1.5 mm. in length and 1.4 in breadth. There

are 27 complete rows with formula 10+1+10 (or 3+7+1+7+3); it resembles that of *vernicosa* in some respects, but differs in having a central tooth. This is long and slender with chisel point, as are the inner lateral teeth, which increase moderately in size from No. 1 to No. 6 (the text-figure shows Nos. 1 to 5 in profile). No. 7 is not only longer, but very stout; Nos. 8 and 9 are similar but diminishing in size;

Text-fig. 7.—Nata viridescens

TEXT-FIG. 7.—Nata viridescens
(M. & P.), Mkolombe.

Half row of teeth of radula; ×200.

similar but diminishing in size; No. 10 is very small and rudimentary.

Genus Natalina Pilsb., 1893

(Manual, viii, p. 135)

(=Aerope Albers, 1860, non (Leach) White, 1847).

Type Helix cafra Fér.

Shell with rather large protoconch composed of about 2 rapidly expanding whorls, with curved radial ribs on their upper surface.

Genital opening on right side of head; lower left body lobe not

very prominent but extending far round mantle-edge and more or less connecting with the upper one; kidney not reflexed at front end. Spermoviduct convoluted; duct of spermatheca long and slender; vagina long; penis long and cylindrical; epiphallus entering posterior end of penis, where the retractor is inserted, and resembling the penis in breadth, etc., but not in its internal structure.

Radula with between 55 and 95 rows of teeth, about 35-70 in each row. Central always present, remainder divisible into two series, all unicuspid; laterals with curved, sharply pointed cusps, increasing in size as they are followed outwards, marginals smaller, with straighter and blunter cusps.

### Sub-genus Natalina s.s.

Shell often very large, peristome usually membranaceous instead of more or less thickened, owing to the periostracum being continued a little beyond the calcareous layer of the shell.

Left body lobes connected by a low ridge; free oviduct with an appendiculum which lies against the terminal part of the spermoviduct; genital atrium not usually quite as short as in the other South African groups belonging to this family; epiphallus long; penis situated on right of retractor of right upper tentacle, which does not pass between it and vagina.

Radula with about 5-8 laterals on each side, increasing greatly outwards in size, the last very large; marginals very small, narrow, 10-30 on each side, transition between these and the large admedians being abrupt.

## Natalina cafra (Fér.). (Pl. iii, f. 7, and text-fig. 8.) Ref. List No. 114.

1821. Helix cafra Fér., Tabl. Syst. Moll., pt. 3, p. 29 (or 25). N.

1901.  $Natalina \ caffra$  Fér., Murdoch, Proc. Mal. Soc., iv, p. 171, pl. xvii, f. 11. A.

1903. Natalina caffra Fér., Mlldff., Conch. Cab., p. 20, pl. iii, f. 4–7. D.F.

1934. Natalina cafra Fér., Watson, Proc. Mal. Soc., xxi, p. 157. N.

Shell very large, subglobose, umbilicate, rather thin, rugose, translucent, dull above, glossy beneath, deep yellow- or red-brown with darker transverse patches at irregular intervals, usually caused by the lines of growth. Spire moderately exserted, apex bluntly rounded, whorls 5, moderately convex, rounded at periphery, rapidly increasing, sculptured all over with very close, sharp, regular, curved

transverse costae; suture simple, well defined. Aperture oblong-suboval, descending at base, peristome simple, acute, labrum receding gradually to the base, columella short, erect, margin broadly triangularly reflexed, but scarcely overhanging the rather wide umbilicus.

Diam. maj. (of specimen from "Cape of Good Hope" in British Museum) 75.5, min. 54.5; alt. 50; apert. alt. 42.6, lat. 41.4 mm.

Hab. CAPE PROVINCE. Caffraria (Delalande); Uitenhage (fide Férussac); generally distributed over the central and western districts.

NATAL. Along the coast from Port Shepstone to Tongaat: Pinetown; Pietermaritzburg; Karkloof; Curry's Post (Burnup).

ZULULAND (McKen).

TRANSVAAL. Between Lydenburg and Delagoa (Wilms).

Type ubi?

Animal without tail pore, foot broadly lanceolate, tapering sharply behind, dull grey on sides, dorsum yellowish umber with darker



Text-fig. 8.—Natalina cafra (Fér.), Natal. Half row of teeth of radula;  $\times 20$ .

brown along the tail and three broad streaks along the back; tentacles finely granulated, greyish brown: ocular conical, long and spreading, oral cylindrical and directed forwards, labial, which serve as feelers, short, thick, conic-angular.

The radula figured (text-fig. 8) from Pinetown measures 58 mm. in length and 5 in breadth, not including the marginal teeth; formula 29+5+1+5+29, with 56+n rows; the laterals, which increase rapidly in size from 1 to 5, have large oblong bases; the marginals are degenerate, the inner one is the largest, about half as long as the base of lateral No. 5; they diminish in size outwards. Owing to the folding of the membrane which carries them, it is difficult to be certain of their number and their total width.

The radula of a newly hatched juvenile from Pietermaritzburg is 7 mm. long and 0.5 mm. broad in front, with gradual increase to 1 mm. at the nascent end. It has 35+n rows, with formula 12(?)+5+1+5+12(?). The central and laterals resemble those of the adult, inner marginal almost as long as base of the adjacent lateral; the marginals diminish in size outwards, as in the adult.

### Natalina eumacta (M. & P.). Ref. List No. 121.

1892. Helix (Aerope) eumacta M. & P., A.M.N.H., x, p. 237, pl. xiii, f. 4. D.F.

Founded on a single specimen, faded to pale yellow, containing  $4\frac{1}{2}$  whorls, upper surface sculptured with very close, fine, regular, curved transverse striae, which are much fainter beneath, while except on the extreme base the under surface and upper part of the last half-whorl are engraved with close, continuous, microscopic spiral lines.

Diam. maj. 30.7, min. 25.3; alt. 22.1; apert. alt. 16.8, lat. 13.5 mm.

Hab. CAPE PROVINCE (not Natal, as stated by the authors). Bashee River, Idutywa (Crawford).

Type in British Museum.

The spire may be very slightly lower in comparison, and the transverse sculpture a trifle closer and weaker, otherwise the type recalls a worn, immature shell of *N. cafra*.

# Natalina beyrichi (Mts.). (Pl. iv, f. 1–3.)

Ref. List No. 113.

1890. Aerope beyrichi Mts., Sitz.-Ber. Ges. Nat. Fr. Berlin, p. 85. D.

1897. Aerope beyrichi Mts., Archiv f. Naturg., lxiii, i, p. 35, pl. vi, f. 1–3. D.F.

Said to differ from *cafra*, which it resembles in all other respects, in having a far more open umbilicus, more compressed aperture, of which the ends are closer together, and in the sharp subperipheral line of demarcation between the dull costulate upper, and smoother glossy under side.

The shell figured, from Port St. John's, which practically coincides with Martens' figure, contains 5 whorls, earlier olive-brown, shading on the last to olive-green, with darker rays at frequent intervals, upper surface dull and silky, lower glossy; sculptured into extreme apex with strong, slightly curved transverse costulae, extending across the whorl on the protoconch, where they are a little more curly and distant, after which they are close and regular, nearly as strong on base and extending into the umbilicus. Peristome foliaceous, labrum scarcely curved and receding gradu-

ally in profile to the base, columella short, concave, the white margin triangularly reflexed but not approaching the deep, rather broad umbilicus.

Diam. maj. 61·0, min. 49·0; alt. 35·0; apert alt. 27·0, lat. 30·0 mm.

Hab. CAPE PROVINCE. Pondoland (type, Beyrich): Port St. John's (Power).

Type in Berlin Museum.

#### Natalina wesseliana (Kob.).

#### Ref. List No. 114.

1876. Helix caffra Fér., var. wesseliana Maltzan, Kob., Jahrb. D. Mal. Ges., iii, p. 149, pl. v, f. 1. D.F.

1925. Natalina wesseliana Maltz., Conn., Trans. R. Soc. S. Africa, xii, p. 122. N.L.

A magnificent species resembling cafra in every detail except for its nautiloid and consequently lower and longer form, due to the more rapid increase of whorl. An example from Rikatla in my collection containing 4 whorls measures

Diam. maj. 61, min. 46; alt. 42; apert. alt. 33, lat. 36.2 mm.

Hab. "SOUTH AFRICA" (fide Kobelt).

LORENZO MARQUES. Rikatla (Junod).

ZULULAND (Toppin).

Junod writes that the natives think this animal brings ill-luck and crush it when they meet it.

## Natalina quekettiana (M. & P.).

#### Ref. List No. 130.

1893. Helix (Macrocyclis) quekettiana M. & P., A.M.N.H., xii, p. 103, pl. iii, f. 1. D.F.

1894. Helix (Macrocyclis) quekettiana M. & P., Moss, Trans. Manch. Microsc. Soc., p. 24, pl. i, f. 4. R.

1915. Natalina quekettiana M. & P., Wats., Ann. Natal Mus., iii, pp. 168, 185. A.

1932. Natalina quekettiana M. & P., Peile, Proc. Mal. Soc., xx, p. 103. R.

Shell much smaller and comparatively more depressed than cafra, golden brown above and greenish yellow beneath.  $4\frac{1}{2}$  whorls, the first showing faint, curved transverse puckers, which, on the rest of the upper surface, are strong, close, regular costae, becoming very weak on the base, which is covered with extremely faint and close microscopic spiral lines and occasional irregular traces of wider, deeper grooves.

Diam. maj. (type), 30·2, min. 24·5; alt. 18·6; apert. alt. 14·3, lat. 14·1 mm.

Hab. NATAL. Town Bush, Pietermaritzburg (Quekett).

Type in British Museum.

A beautiful, richly coloured shell when in fresh condition.

Watson has described the odontophore and adjacent parts for comparison with those of Apera; the radula is of the same type as that of cafra: formula 14+8+1+8+14; the marginals are extremely degenerate, being even smaller in proportion than those of cafra.

#### Natalina compacta sp. n.

(Pl. iii, f. 1-3.)

Shell large, globose, umbilicate, thin, asperate, dull above and rather glossy beneath, semi-transparent, colour scheme of irregular streaks and patches of olive-green and brown, varying in intensity. Spire exserted, apical angle 110°, apex broad, obtuse. Whorls 4, convex and rounded, regularly increasing, sculptured with close, strong, coarse, straight, slightly oblique transverse costae, which become finer on the base; suture well defined. Aperture subovate, but little oblique, peristome simple, acute, slightly overlapped by the fringe of the epidermis, labrum extremely gently recurved in profile, columella white, erect, nearly straight, margin triangularly reflexed, half overhanging the comparatively narrow umbilicus. Diam. maj. 51·0, min. 46·5; alt. 43·0; apert. alt. 33·0, lat. 27·0 mm.

Hab. CAPE PROVINCE. Mountain Drive, Grahamstown (type, Farquhar); East London (fide Falcon); Hog's Back, Amatola Mts. (Rattray).

Type in British Museum.

Distributed by Farquhar under the name of cafra Fér., but a glance at Deshayes' figure of that species \* will show that the latter is far flatter with more rapidly increasing whorls, a completely typical example from Durban measuring

Diam. maj. 67.0, min. 52.5; alt. 40.0; apert. alt. 36.5, lat. 35.0 mm. Of the only other large members of this genus, wesseliana Kob. has even more rapidly increasing whorls than cafra, while beyrichi Mts. is a widely umbilicate shell,  $62 \times 40$  mm. in diameter and altitude.

## Natalina reenenensis sp. n.

(Pl. ii, f. 5-8.)

Shell of good size, depressed globose, umbilicate, very thin, semi-transparent, silky, olive-green with numerous irregular darker transverse strigae. Spire little exserted. Whorls 4, little convex, rapidly increasing, extreme apex smooth and glossy, with 6 or 7 rather coarse and distant wrinkles towards the end of, and extending nearly across the 1st whorl, succeeded on the 2nd and later by strong, close, regular, slightly curved and oblique transverse costulae, with very close, fine microscopic lineation on the last, stronger and crossing the transverse riblets

<sup>\*</sup> Hist. Moll., i, p. 198, pl. ix, A, f. 8.

on the base, where there are further irregular, discontinuous spiral grooves; suture simple, well defined. Aperture narrow sub-oval, slightly descending from the horizontal, labrum membranaceous from suture to left of base, where it becomes white and thickened before merging into the very short, concave columella, of which the margin is little reflexed, not overhanging the umbilicus; a thin white callus is usually present.

Diam. maj. 31.0, min. 24.3; alt. 19.0; apert. alt. 14.0, lat. 16.5 mm.

Hab. NATAL. Van Reenen (Burnup).

Type in British Museum.

This species has long been misidentified as N. kraussi (Pfr.), which belongs to a different sub-genus, and from which it differs, inter alia, in being nearly twice as large, of greener colour, and its membranaceous peristome, whereas kraussi has a brown shell with slightly thickened peristome.

The radula is similar to that of cafra, formula 16(?) + 5 + 1 + 5 + 16(?); the marginals are very small and do not diminish to the same extent as in that species.

# Natalina inhluzana (M. & P.). Ref. List No. 122.

1894. *Helix* (*Dorcasia*) *inhluzana* M. & P., A.M.N.H., xiv, p. 91, pl. i, f. 4. *D.F.* 

1934. Natalina inhluzana M. & P., Watson, Proc. Mal. Soc., xxi, p. 158. N.

Shell depressed globose, umbilicate, glossy, chestnut brown above, shading to olive-buff around the umbilicus. 4 convex whorls, first  $1\frac{1}{2}$ , after the extreme apex, bearing strong curved growth wrinkles below the upper suture, which fade from the middle of the whorl and reappear weakly above the lower, the entire surface, especially the smooth unwrinkled zone, showing extremely close, fine, faint microspiral lineation, later whorls covered with close, fine, regular, curved, slightly oblique transverse costulae, while there are traces of faint, fine microspiral lineation and shallow basal grooves; suture well defined. Aperture nearly horizontal, little descending, peristome white and glossy, with a very weak internal rib, columella short, concave, margin very narrowly reflexed, not overhanging the deep subfunicular umbilicus.

Diam. maj. 23·0, min. 19·4; alt. 14·0; apert. alt. 11·7, lat. 11·7 mm.

Hab. NATAL. Inhluzani Mountain (Mrs. Shaw).

Type in British Museum.

The apical sculpture is described from a younger and fresher specimen than the type; as Watson remarks, this is probably the smallest and least specialised species of *Natalina* sensu stricto, unless that which follows really belongs to the same section.

# Natalina caffrula M. & P. Ref. List No. 115.

1898. Natalina caffrula M. & P., A.M.N.H., i, p. 24, pl. viii, f. 1. D.F.

1936. Natalina caffrula M. & P., Haas, Abh. Senckenb. Ges., No. 431, p. 18.  $\,L$ .

Shell small, depressed globose, widely umbilicate, rather thin, silky, semi-transparent, dark corneous umber, with irregular darker transverse streaks. Spire moderately exserted. Whorls about 4, convex, regularly increasing, first 2 defective, but apparently smooth, remainder covered with close, regular, curved transverse costulae, which are nearly as strong on the base; no spiral sculpture apparent; suture simple, well defined. Aperture lunate, peristome simple, acute, labrum gently recurved to the base, columella short, concave, upper margin scarcely expanded, not obscuring the wide, open umbilicus.

Diam. maj. (type), 11.2, min. 9.8; alt. 7.1; apert. alt. 5.0. lat., 4.3 mm.

Hab. CAPE PROVINCE. Knysna (type, Purcell); north bank of Zwartkops R., Port Elizabeth (fide Crawford).

NATAL. Durban (Penther, fide Sturany).

ZULULAND. Mkuzi; Umfolosi Game Reserve (fide Haas).

LORENZO MARQUES. Matolla (Penther, fide Sturany).

Type in British Museum.

The type is the only example of this species known to me; it is a beautiful miniature of the gigantic caffra and is notable for its dark coloration. The localities given by Crawford and Sturany are probably incorrect, and Haas' shells have been found to represent a species of Nata, aff. vernicosa, but in too poor condition for exact determination.

# Sub-genus A fror hytida Mlldff., 1903 (Conch. Cab., p. 61).

Type Helix knysnaensis Pfr.

Shell not banded; peristome nearly always somewhat thickened; radial ribs on protoconch not cut by spiral grooves, but in some species only extending part way across upper surface of whorl.

Left body-lobes connected by a low ridge, as in *Natalina* s.s.; genital organs similar to those of *Capitina*, except that the epiphallus is much longer.

Radula with about 7-12 laterals on each side, increasing in size outwards, at first slowly and then rapidly, the last being very large; marginals very much smaller, but separated from admedians by 2 or 3 transitional teeth of intermediate size.

### Section Afrorhytida s.s.

Shell with ribs on upper surface becoming weaker on last whorl; umbilicus narrow in immature shells, though sometimes expanding later in depressed examples.

Cusps of inner laterals with narrow or no lateral flanges; marginals narrower than in Hyperrhytida, about 12-22 on each side.

Natalina knysnaensis (Pfr.).

(Text-fig. 9.)

Ref. List No. 124.

1845. Helix knysnaensis Pfr., P.Z.S., p. 131. D.

1934. Natalina knysnaensis Pfr., Watson, Proc. Mal. Soc., xxi, p. 156. N.

Shell of fair size, subglobose, umbilicate, thin, silky, glossy, semi-transparent, corneous, dark to yellow brown, the type being of the former shade. Spire moderately exserted, apex bluntly rounded. Whorls 4, convex, rounded at the periphery, rather rapidly increasing, first 11/2 smoothly malleate, but considerably worn in all specimens that I have been able to examine, remainder sculptured above with close, regular, nearly straight transverse costulae which become much weaker beneath, and both the base and upper surface of the last whorl show a certain amount of extremely faint microscopic spiral striation; suture simple, rather deep. Aperture 3-lunate, descending a little at base, peristome white, glossy, almost imperceptibly thickened, labrum nearly straight in profile, receding gradually to the base, columella short, margin triangularly reflexed, overhanging a quarter of the umbilicus.

Diam. maj. (type) 24.2, min. 20.7; alt. 17.4; apert. alt. 13.4, lat. 11.3 mm.

Hab. CAPE PROVINCE. Knysna (type, coll. Cuming); Port

Elizabeth (Crawford: quhar); Somerset East (Miss Bowker); Enon (Hartvig).

Type in British Museum.

The radula figured is in the Gwatkin collection, labelled "Cape"; it measures 14.5 mm. in length and about 2 in breadth, marginals not included. There are 79 complete rows of teeth with formula 16+11 +1+11+16: the laterals increase regularly in size from

Text-fig. 9.—Natalina knysnaensis (Pfr.), "Cape."

Half row of teeth of radula;  $\times 40$ .

No. 1 to No. 8; Nos. 9, 10, and 11 are still larger with big, oblong bases, No. 10 being the largest of all. The inner marginal is about the same size as No. 5 lateral, the remainder diminish rapidly, the outermost being very small.

 $Natalina\ coerneyensis$  M. & P.

Ref. List No. 118.

1894. Natalina coerneyensis M. & P., A.M.N.H., xiv, p. 91, pl. i, f. 2. D.F.

1894. Natalina coerneyensis M. & P., Moss, Trans. Manch. Microsc. Soc., p. 25, pl. ii, f. 2. R.

The type is an immature shell with a broken, and hence deformed aperture; it contains  $4\frac{1}{4}$  whorls, with exactly the same sculpture as knysnaensis, with which it appears to be completely identical.

Diam. maj. 23·2, min. 19·0; alt. 18·1; apert. alt. (deformed) 11·7, lat. 11·0 mm.

I would have placed this species without hesitation in the synonymy of knysnaensis were it not that the radula figured by Moss and Webb and that in the Gwatkin collection, both of which are attributed to coerneyensis, disagree with that figured above as of Pfeiffer's species. Further anatomical knowledge of topotypes is therefore advisable before attempting any definite conclusion.

Hab. CAPE PROVINCE. Coerney (type); Sandflats Station (Crawford).

Type in British Museum.

Natalina kraussi (Pfr.).

(Pl. iii, f. 8–10.)

Ref. List No. 125.

1846. Helix kraussi Pfr., Symb., iii, p. 70. D.

1848. ,, ,, Krs., Südafr. Moll., p. 77, pl. iv, f. 24. *D.F.* 

1851. ,, sturmiana Pfr., P.Z.S., p. 253. D.

Shell of fair size, depressed globose, umbilicate, thin, silky, semi-transparent, corneous brown above, paler beneath. Spire not much exserted, apex obtuse. Whorls 4, moderately convex, rapidly increasing, rounded at the periphery, upper surface sculptured to the extreme apex with strong, close, slightly curved and oblique costulae, which become slightly less close on the later whorls, and tend occasionally to bifurcate and merge into one another, and are much weaker on the glossy base, where there are a few negligible traces of coarse, irregular, much broken spiral grooves or scratches; suture simple, well defined. Aperture oblong suboval, peristome white and glossy, infinitesimally thickened, labrum nearly straight and receding regularly in profile, columella concave, margin scarcely reflexed, umbilicus wide and funicular. The type measures

Diam. maj. 20.7, min. 16.7; alt. 13.0; apert. alt. 10.0, lat. 10.6 mm.

Although the type is in fresh condition, the protoconch bears an extraordinary hammered appearance, as though it has been crushed

in youth, so that it is barely possible to discern the radial wrinkles described above, though there are traces of them in some of the indentations.

H. sturmiana was described from a shell in the Cuming collection, "Hab. (?)", but in the Nomenclator Pfeiffer ascribed it without apparent justification to Delagoa Bay. It has 4 whorls and agrees with the foregoing in all respects except that, being a slightly better grown specimen, the peristome is more thickened; basal margin extremely narrowly reflexed and columellar margin clearly so, though not overhanging the umbilicus. It measures

Diam. maj. 21.8, min. 17.8; alt. 13.6; apert. alt. 10.0, lat. 10.0 mm. Hab. CAPE PROVINCE. Outeniqua, George District (kraussi, Krauss); Knysna (Power); Tharfield (Miss Bowker) and Grahamstown (Miss Glanville, fide Layard); Kromme River (Moran); Zuurbrak Peak, Langeberg Range near Swellendam, 4500 feet (fairly typical, 24.6 × 19.6, alt. 12.5, apert. alt. 11.7, lat. 12.2 mm.); Meirings Poort Berg, Prince Albert, 6-6500 feet (umbilicus rather more narrow than type,  $23.8 \times 18.2$ , alt. 11.7, apert. alt. 10.5, lat. 12.6 mm.); Lemoens Hoek Mts., Langeberg, Heidelberg Dist. (an unusually flat spired example with 4 whorls and noticeably weaker costulation on the last \( \frac{1}{4} \) whorl; 24 × 18.6, alt. 12.5, apert. alt. 10.0, lat. 10.5 mm., Barnard); Doorn R., N. of Montagu Pass (Haughton).

Type of kraussi in Stuttgart, sturmiana in British Museum.

The newly described N. reenenensis has been freely distributed as the present species and led to considerable confusion; N. inhluzana resembles it closely but its anatomy proves it to belong to Natalina s.s.

The limits of variation and distribution of N. kraussi are by no means clearly defined, and it is probable that some of the races mentioned above will prove to be at least varietally distinct when their anatomy is known.

# Natalina insignis M. & P. Ref. List No. 123.

1907. Natalina insignis M. & P., A.M.N.H., xix, p. 98, pl. vi, f. 9. D.F.

The chief characteristic of this species is an extremely slight thickening and expansion of the glossy, white peristome; the shell is uniform corneous yellowbrown, with a moderately exserted spire, and contains 5 convex whorls, first  $1\frac{1}{2}$ smooth in the weathered type, remainder sculptured with close, regular, rather weak, curved transverse striae, without spiral sculpture; umbilicus partially overhung by columellar margin.

Diam. maj. (type) 29.3, min. 25; alt. 21.6; apert. alt. 15.3, lat. 13.8 mm. VOL. XXXIII.

Hab. CAPE PROVINCE. Teafontein, Grahamstown (Farquhar). Type in British Museum.

Considerably higher in the spire than kraussi, with the aperture much less broad in comparison to its height.

## Natalina liliacea Prest. Ref. List No. 127.

1912. Natalina liliacea Prest., Proc. Mal. Soc., x, p. 17. D.F.

Perhaps a little less globose than *knysnaensis*, which it otherwise resembles in form. Four whorls, upper surface sculptured all over with strong, close, regular, curved transverse striae, becoming weaker on the base, which shows traces of microscopic spiral lines; umbilicus narrow, but deep and not overhung.

Diam. maj. (paratype in British Museum) 20·5, min. 16·6; alt. 13·8; apert. alt. 10·2, lat. 9·4 mm.

Hab. CAPE PROVINCE. Knysna Forest (type, Cox); Zwartberg Range, between Prince Albert and Oudtshoorn; Keurbooms R. Bush (Barnard).

Type in coll. Dautzenberg.

The shell is prone to assume a distinct lilac hue in rather weatherworn condition; the largest I have seen measures  $27 \times 15.8$  mm. in breadth and height.

# Section Hyperrhytida Watson, 1934 (Proc. Mal. Soc., xxi, p. 156) Type Helix (Aerope) trimeni M. & P.

Shell with ribs on upper surface remaining strong on last whorl, umbilicus broad at all stages of growth.

Cusps of inner laterals with wide lateral flanges; marginals with broadly rounded cusps, and only about 5 in number on each side.

# Natalina trimeni (M. & P.). Ref. List No. 133.

1892. *Helix* (*Aerope*) *trimeni* M. & P., A.M.N.H., x, p. 237, pl. xiii, f. 1. D.F.

1934. Natalina trimeni M. & P., Watson, Proc. Mal. Soc., xxi, pp. 156, 157, pl. xix, f. 10. N.R.

More depressed than knysnaensis, with a wider, more open umbilicus, silky above, very glossy beneath, pale chestnut (in the type) to corneous yellow-brown.

4¾ whorls, the 1st showing faint, curved, transverse puckers, which, on the rest of the upper surface, are strong, close costae, becoming very weak on the base, which is covered with extremely faint and close microscopic spiral lines, with occasional irregular traces of wider, deeper grooves. Peristome white and minutely thickened.

Diam. maj. (type) 24.2, min. 20.7; alt. 16.2; apert. alt. 11.6, lat. 10.6 mm.

Hab. CAPE COLONY (type, Trimen). Grahamstown (Farquhar); Kowie, Port Alfred (fide Crawford).

Type in British Museum.

The sculpture is that of quekettiana, but the shell is smaller and comparatively higher, with thickened peristome and wider umbilicus.

# Natalina arguta M. & P. Ref. List No. 112.

1907. Natalina arguta M. & P., A.M.N.H., xix, p. 98, pl. vi, f. 8. D.F.

1934. Natalina arguta M. & P., Watson, Proc. Mal. Soc., xxi, p. 156. N.

Separable from trimeni by its stronger basal striation, rather more open umbilicus, and possibly smaller size, although the type may be immature. It contains  $4\frac{1}{2}$  whorls, sculptured all over, except on the extreme apex, with close, regular, curved oblique striae, which are extremely weak on the first  $1\frac{1}{2}$  whorl and then grow stronger; no apparent spirals.

Diam. maj. (type) 20.5, min. 17.4; alt. 13.0; apert. alt. 9.8, lat. 9.3 mm.

Hab. CAPE PROVINCE. East London (Burnup).

Type in British Museum.

Radula as in the section.

Sub-genus Capitina Watson, 1934 (Proc. Mal. Soc., xxi, p. 153). Monotype Helix schaerfiae Pfr.

Upper and lower left body lobes completely united to form a single extensive lobe. Free oviduct somewhat swollen, but without appendiculum; epiphallus very short; penis situated on left of retractor of right upper tentacle.

Radula with about 13 lateral and 17 marginal teeth on each side, latter with broadly rounded cusps; the teeth enlarge gradually from the 1st to about the 9th, remaining laterals scarcely differing in size, marginals gradually decreasing again in size to edge of row.

Natalina schaerfiae (Pfr.). (Pl. iv, f. 6–11, and text-fig. 10.) Ref. List No. 131.

1861. Helix schaerfiae Pfr., Mal. Blätt., viii, p. 73, pl. ii, f. 1–3. D.F.

1915. Tulbaghinia schaerfiae Pfr., Conn., Ann. S.A. Mus., xiii, p. 174. D.

1934. Natalina schaerfiae Pfr., Watson, Proc. Mal. Soc., xxi, p. 153, pl. xix, f. 1-4. D.A.R.

Shell large, much depressed globose, umbilicate, moderately solid, semi-transparent, dull and silky above, glossy beneath, corneous olive-brown, ornamented above with narrow chestnut bands. Spire little raised, apex obtuse. Whorls 4½, scarcely convex, rapidly increasing, rounded at the periphery, sculptured above with coarse, irregular, curved, oblique transverse costulae, which are much weaker on the base; suture simple, well defined. Aperture oblong suboval, peristome white, glossy, slightly thickened, labrum nearly straight and receding evenly in profile, columella short and concave, margin very slightly reflexed, umbilicus funicular, rather wide.

Diam. maj. (of specimen from Oudebosch in my collection) 29·2, min. 23·1; alt. 15·5; apert. alt. 13·0, lat. 13·8 mm.

Hab. CAPE PROVINCE. Bredas Bosch, Genadendal District (type, Mrs. Schaerf); Oudebosch, R. Zonder End Mts. (Layard; Barnard); Bredasdorp (Layard; de Villiers).

Type in Stettin Museum.

The radula figured, from Oudebosch, measures 15.5 by about 2.5 mm. in length and breadth; there are 77 complete rows with formula

14 1 c 1 1 d 25 28

Text-fig. 10.—Natalina schaerfiae (Pfr.), Oudebosch. Representative teeth from the radula; ×80.

28+1+28. These rows are much less oblique than in the other subgenera, meeting at an obtuse angle in the centre of the radula and flattening out towards the margins; the teeth are of simple aculeate form, but those towards the edges have unusually broad and rounded

cusps; there is a gradual increase in size to No. 14 and an equally gradual decrease to No. 27; No. 28 is very small.

The bright olive ground colour appears to fade rapidly when much exposed to the sun, for Layard wrote that while the normal variety inhabits the dense forests of Oudebosch, the specimens from the open veldt at Bredasdorp are almost destitute of epidermis. The shells to which he refers are otherwise in fine condition, the ground colour being creamy white, retaining the bright chestnut bands, and thus presenting a strikingly handsome appearance; the largest of them is  $31.5 \times 19.5$  mm.

All de Villiers' examples are bleached white and show far fewer bands, usually 2 or 3, somewhat distant, above the periphery.

#### FAMILY TESTACELLIDAE.

Characters those of the single genus.

Owing to absence of jaw I place the family here, but its more natural position is perhaps before the Achatinidae.

> Genus Testacella Cuvier, 1800 (Lec. Anat. comp. Paris, i, Table 5). Type T. haliotidea Drap.

Body subcylindrical, attenuate anteriorly, peripodial grooves distinct, mantle small, situate in the rear of animal and covered by a somewhat auriform, paucispiral shell; respiratory and anal orifices beneath right posterior angle of shell, sexual orifice beneath right ommatophore. Internally the most important peculiarity is the location of the heart near the hind end of body and the large radula with slender barbed teeth.

# Testacella maugei Fér. (Pl. xiv, f. 2.)

Ref. List No. 5 (as aurigaster).

1801. Testacella haliotoides Lam., Syst. An. s. ver., p. 96, nomen nudum.

1819. Testacella maugei Fér., Hist. Moll., ii, p. 94, pl. viii, f. 10, 12. D.F.

1893. Testacella aurigaster Layard, Ckll., Conchologist, ii, p. 205. N. 1902. Testacella maugei Fér. (=aurigaster Layard), Taylor, Mon. Brit. Moll., ii, p. 21, pl. i, f. 9-14. D.F.A.R.

1915. Testacella maugei Fér. (=aurigaster Layard), Wats., Ann. Natal Mus., iii, pp. 220, 256, pl. xxiv, f. 152–161. D.F.A.R.

1916. Testacella maugei Fér. (= aurigaster Layard), Conn., Ann. S.A. Mus., xiii, p. 182. N.

1921. Testacella maugei Fér., Wats., Naturalist, p. 401. Synonymy.

Animal attenuate anteriorly and very tumid towards the rear, greyish white to black, but usually earthy brown, paler on sides, dotted, especially on back, with deep brown specks; dorsal grooves well defined, enclosing a double row of tubercles, lateral deep, wide apart at their origin, sole usually yellow, mantle sparsely spotted, sometimes partially enclosing the shell, which in a Cape Town example is subelliptical, convex, apex terminal, just protruding beyond hind margin; periostracum pale brown, with strong quasi-concentric lines of growth, which circle from the apex downward to the left and round, till they become merged in the thick, white, glossy columella.

Length of animal extended, 60 to 100 mm.; shell long. 8.8, lat. 5.8, alt. 2.2 mm. Radula with minute central tooth, marginals barbate, increasing in size till about No. 11 and then growing smaller; formula given by Taylor is  $(14+1+14) \times 30$ .

Hab. CAPE PENINSULA. Cape Town (aurigaster, Layard, Lightfoot).

Recorded from Western Europe, Morocco, and the North Atlantic islands, whence its introduction to the Museum gardens at Cape Town is easily accountable.

Lamarck's reference to this slug in 1801 is confined to the words "Testacella haliotoides n. ex D. Mauger, ex ins. Teneriffae," which cannot possibly be held sufficient to validate his name, and although Draparnaud mentions the Teneriffe slug in a footnote with his first description in 1801 of T. haliotidea, he describes the common French form, which is quite distinct from the present species.

#### var. aperta Taylor.

1902. Testacella maugei Fér., var. aperta Taylor, Mon. Brit. Moll., ii, p. 24, pl. i, f. 15. D.F.

1915. Testacella maugei Fér., var. aperta Taylor, Wats., Ann. Natal Mus., iii, p. 222, pl. xxiv, f. 162. Shell.

"Shell comparatively wider and flatter or less convex than type, aperture consequently more open and ovate."

"Long. 14, lat. 8, alt. 3 mm."

Hab. with type.

#### TRIBE HOLOGNATHA.

Jaw simple, without superior appendage.

#### FAMILY HELICARIONIDAE.

Shell helicoid or vitrinoid, sometimes large enough to contain entire animal, sometimes smaller, thin and partly covered by shell lobes, and sometimes hardly spiral and entirely enclosed within mantle. Foot usually with caudal pore, lateral grooves, and tripartite sole; jaw usually with median projection, radula with narrow maginal teeth: dart gland, when present, often containing a stilettiform body, which cannot be cast off as in the Helicidae.

#### Sub-Family Helicarioninae.

Shell usually thin, of vitrinoid or helicoid form; mantle with shelllobes; foot with large caudal gland; epiphallus developed; vagina short or hardly distinct from atrium; right ocular retractor passing between male and female ducts of genitalia.

Although not without a tinge of sentimental regret, I am obviously bound to follow Watson in his reclassification of the South African members of this sub-family, the outcome of which is the subordination to it of the Sheldoniinae and the reduction of Austen's genus Kerkophorus to a sub-genus of Sheldonia, which necessitates a new name being found for the old-established Kerkophorus (olim Vitrina) natalensis (Krs.), now merged in the same genus as Sheldonia (olim Helix) natalensis (Pfr.), a peculiarly inappropriate name for a species of which the established range does not extend nearly so far eastward as Natal.

> Genus Gymnarion Pilsb., 1919 (Bull. Amer. Mus. N.H., xl, p. 275). Type H. aloysii-sabaudiae Pollon.

Protoconch spirally punctate or smooth, remaining whorls very finely microscopically granulate except on base; shell-lobes narrow, separate, usually small; left body lobes united: median projection of jaw prominent, central and lateral teeth normal, marginals variable in form but never very numerous. Epiphallus present, but no flagellum; penis ending in a slight knob, into which the epiphallus enters and the retractor muscle is inserted; spermatheca usually oval, with comparatively short duct; genital atrium often bearing an elongated non-muscular amatorial organ.

Sub-genus Gymnarion s.s.

Shell thin, vitriniform.

# Gymnarion nyasanus (Smith). (Text-fig. 11.)

1899. Helicarion nyasanus Smith, P.Z.S., p. 582, pl. xxxiii, f. 9-10. D.F.

1925. Helicarion (Gymnarion) nyasanus Smith, Conn., Trans. R. Soc. S. Africa, xii, p. 123, pl. v, f. 4-8. D.A.R.

Shell of medium size, imperforate, subnautiloid, very thin, translucent, dull above, somewhat iridescent beneath, apex light brown, remainder pale olivaceous. Spire flat, apex rounded. Whorls 3, very rapidly increasing, flat above, rather narrowly rounded at periphery, protoconch (1½ whorls) engraved with close, microscopic, dotted spiral lines which appear continuous owing to the close proximity of the dots in each line, and showing a few faint transverse wrinkles, remainder rather irregularly sculptured with close, faint striae, following the shape of the outer lip and covered by very minute microscopic granulation; suture subfiliform. Aperture ovate, peristome thin, simple, straight above until near periphery, when it recedes sharply, gently curved beneath; columella concave, very weak.

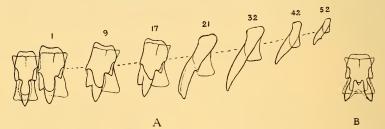
The shell described, from Macequece, measures

Diam. maj. 17.0, min. 13.3; alt. 7.9; apert. alt. 8.3, lat. 10.5 mm.

Hab. LORENZO MARQUES. District north of Macequece (Cressy).

Type in British Museum.

Described from Southern Nyasaland, where it is widely distributed. Sole tripartite, foot truncate behind, with caudal pore and short pointed lobe, foot-fringe rather broad, bounded by a peripodial groove,



Text-fig. 11.—Gymnarion nyasanus (Smith), Macequece.

A. Representative teeth from the radula;  $\times 250$ . B. Central tooth from radula of another specimen;  $\times 250$ .

above which is another, separated from it by a single row of rugae; no keel. Body lobes broad, the left being undivided, shell lobes rather narrow. Animal of light colour except for two dark bands running for a short distance along the hinder end of foot. Radula  $4.7 \times 2.2$  mm. when flattened, central and inner laterals tricuspid, but endocones of outer laterals tend to become united with the mesocone, marginals mostly unicuspid; formula  $(39+18+1+18+40)\times 114$ .

#### Gymnarion masukuensis (Smith).

1899. Helicarion masukuensis Smith, P.Z.S., p. 582, pl. xxxiii, f. 11-12. D.F.

1911. Helicarion masukuensis Smith, Thiele, D.Z.-A.-Exp., iii, p. 196. D.F.A.

Shell small, subglobose, perforate, thin, smooth, glossy, transparent, pale yellowish or greenish brown. Spire moderately raised, apex obtuse. Whorls  $2\frac{1}{2}$ , moderately convex, protoconch smooth, remainder bearing weak, slightly curved and oblique growth wrinkles; suture normal. Aperture  $\frac{7}{8}$ -lunar, labrum receding slowly in gentle curve, columella short, extremely narrowly reflexed over the small umbilicus. The type measures

Diam. maj. 13.4, min. 10.3; alt. 6.9; apert. alt. 6.8, lat. 7.7 mm.

Hab. S. RHODESIA. Bindura (Coghill).

Type in British Museum.

Described from Nyasaland and also recorded from Tanganyika Territory.

The shell is smaller, glossier, and more high spired than nyasanus, which, according to Thiele, it resembles in colour of the animal; mantle lobes very small, roundly triangular, pedal grooves indistinct, spermiduct without appendix.

## Sub-genus Lacrimarion nov.

# Type G. lacrimosus Conn.

Shell heliciform, comparatively solid, with strong granulate sculpture somewhat in the form of tear-drops; anatomy, so far as examined, attributed by Watson to *Gymnarion*.

The shell is so completely unlike that of *Gymnarion* and other African Helicarions that no one would at first, or even second sight, associate it with that group; at least sub-generic status, therefore, appears advisable to enable it to be sought therein, if it prove to belong to it on further anatomical investigation.

### Gymnarion lacrimosus Conn.

1929. Gymnarion lacrimosus Conn., Ann. Natal Mus., vi, p. 224, pl. xiv, f. 6-9. D.F.R.

Shell of moderate size, depressed globose, narrowly umbilicate, thin, dull, granulate, semi-transparent, corneous yellow-brown. Spire moderately elevated, sides subgradate, apex rounded. Whorls 4, convex, rather rapidly increasing, rounded at periphery, the last descending steeply towards the aperture, protoconch, 13 whorl, engraved almost into extreme apex with very close and fine, regular, spiral grooves; upper surface of remainder covered with close, coarse, regular,

oblique transverse wrinkles, which are cut up into granules by continuous spiral lines, the wrinkles becoming coarser and the granules longer on each succeeding whorl; the same sculpture continues almost to the umbilicus, but the spirals are extremely faint on base.

Diam. maj. 12.8, min. 10.5; alt. 9.0; apert. alt. 5.0, lat. 6.8 mm.

Hab. KAOKOVELD. Kaoko Otavi (Barnard).

Type in South African Museum.

Jaw thin, with weak median projection, radula formula  $39+1+39\times(89+\text{nascent})$ , central tricuspid, laterals with strong ectocone and small endocone, marginals aculeate, endocone lacking.

Genus Sheldonia Ancey, 1888 (Conchologists Exchange, i, p. 53).

Type Helix trotteriana Bs., nominated by Connolly, 1925

Sub-genus Sheldonia s.s.

(=Peltatus G.-Aust., 1908).

Shell vitrinoid, depressed globose, or globosely conoid, thin and corneous, with simple peristome.

Foot with tripartite sole, peripodial grooves, and well-developed caudal mucous pore, overhung by a pointed lobe of varying length; genital opening rather low down on right side of head, right and left shell lobes present, upper and lower left body lobes contiguous but separated by a slit; kidney sigmurethrous, broader behind than in front, but not curving up to the rectum; ureter continuing forward beneath rectum as a secondary ureter. Spermatheca large, situate beside the spermoviduct, epiphallus bearing at its junction with vas deferens a well-developed flagellum, in which is secreted a long spermatophore furnished with branched spines, and near its other end a caecum, which is shorter than the flagellum; penial retractor attached to epiphallus between base of caecum and entrance of epiphallus into hinder end of penis; retractor of right upper tentacle passing between penis and vagina; dart sac absent.

Jaw of usual oxygnathous type, central projection usually well developed; central and lateral teeth of the quadrate type, central tricuspid, laterals 8 to 16 on each side, tricuspid or bicuspid, marginals of aculeate type, numerous and crowded, with narrow bases and curved cusps, which are usually bifid, but variable towards outer edge of radula. Austen's terminology of the radula in his work on this group is very misleading, and is modified considerably in the following pages.

I showed in 1925 that all the species included by Ancey in Sheldonia were also included by Austen in Peltatus, so that the latter must yield precedence. The shell is subglobose to subconical, protoconch sculptured with close microscopic spiral and radial striae, which intersect each other and leave regular lines of little hollows between them, contrasting with the finer sculpture on the later whorls of the shell.

Group 1. Apical sculpture of practically continuous microspiral lines, formed by coagulation of the punctate dots.

#### Sheldonia trotteriana (Bs.).

Ref. List No. 165.

1848. Helix trotteriana Bs., A.M.N.H., ii, p. 161. D.

1912. Peltatus trotteriana Bs., G.-Aust., A.M.N.H., ix, p. 135, pl. v, f. 2; pl. vi, f. 1. D.A.R.

Shell comparatively large, globose, imperforate, thin, smooth, transparent, rather dull, corneous brownish yellow. Spire moderately exserted, summit broadly rounded. Whorls 44, moderately convex, rapidly increasing, rounded at periphery, protoconch engraved with extremely close, fine, faint microscopic spiral lines, of which there are irregular traces on the rest of the shell, but so faint as to be practically negligible; transverse sculpture close, faint striolae of irregular strength, strongest near the suture, which is simple, well defined. Aperture somewhat descending, nearly circular, labrum nearly straight and receding evenly in profile, columella short, margin white and slightly thickened, but not reflexed.

Diam. maj. 17.6, min. 15.0; alt. 15.6; apert. alt. 12.4, lat. 10.6 mm.

Hab. CAPE PROVINCE. Uitenhage (type, Trotter); Port Elizabeth (Crawford); Knysna (Purcell); Cradock (Farquhar): Bokkeveld (Layard); Mossel Bay (Power); Graaff Reinet (Ogilvie).

Type in British Museum; shell described from Cradock in my collection.

The foot is short, very evenly divided, lobe over mucous gland very small; right shell lobe very small, left minute; genitalia as in the genus, epiphallus long, with a short caecum about midway: a rather short, thick flagellum at the junction of the vas deferens; spermatheca globose on a thin stalk.

Radula formula of this specimen 58+2+12+1+12+2+58; that of another was 65+2+11+1+11+2+65, but the animal of the latter seems so different from that here described that its affinity is rather doubtful. (After Austen.)

# Sheldonia capsula (Bs.). Ref. List No. 159.

1864. *Helix capsula* Bs., A.M.N.H., xiii, p. 492. *D*.

1892. Nanina hypochlora M. & P., A.M.N.H., ix, p. 87, pl. iv, f. 8. D.F.

Shell of moderate size, depressed globose, imperforate, thin, rather silky, transparent, corneous yellow-brown with a tinge of green. Spire little raised, apex broadly rounded. The largest specimen in the British Museum contains  $4\frac{1}{2}$  flattish, regularly increasing whorls, protoconch, 2 whorls, devoid of transverse sculpture but engraved to the apex with very close, fine, microscopic spiral lines, which continue much more faintly on the upper surface of the later whorls but are practically invisible on the base; after the first 2 whorls the transverse sculpture above and beneath consists of very weak, irregular growth wrinkles; suture simple, well defined. Aperture  $\frac{3}{4}$ -lunate, labrum regularly receding, columella simple, very short.

Diam. maj. 14·5, min. 12·0; alt. 8·5; apert. alt. 7·0, lat. 7·8 mm.

Hab. CAPE PENINSULA. Simonstown (Layard; Connolly). CAPE PROVINCE. Sir Lowry's Pass (Connolly).

Of similar form to asthenes, but with more depressed spire, flatter whorls, and greener colour. N. hypochlora was described from "Cape of Good Hope"; it is absolutely identical with capsula.

Type of capsula in Cambridge, hypochlora in British Museum.

Austen describes the animal and anatomy, which agrees closely with that of the genus in general.

# Sheldonia perlevis (Prest.). Ref. List No. 140.

1912. Zingis perlevis Prest., Proc. Mal. Soc., x, p. 17. D.F.

Shell rather small, depressed globose, narrowly rimate, thin, smooth, glossy, transparent, pale corneous buff. Spire but little raised, apex bluntly rounded. Whorls  $4\frac{1}{2}$ , nearly flat, regularly increasing, rounded at the periphery, protoconch, 2 whorls, engraved almost to the extreme apex with countless extremely close and fine, hardly visible microscopic spiral lines, remainder nearly smooth, with practically no trace of spiral sculpture; suture simple, well defined. Aperture sublunate, rounded, but scarcely descending at base, peristome simple, acute, columella slightly concave, margin narrowly reflexed, forming a small rima.

Diam. maj. 12·3, min. 11·3; alt. 8·7; apert alt. 6·8, lat. 6·0 mm.

Hab. CAPE PROVINCE. Knysna Forest (Cox).

Type in coll. Dautzenberg.

Description from paratype in British Museum.

From its helicoid form and apical sculpture this species appears best placed in *Sheldonia* s.s.

# Sheldonia arnotti (Bs.). Ref. List No. 156.

1864. Helix arnotti Bs., A.M.N.H., xiii, p. 491. D.

1929. Sheldonia arnotti Bs., Conn., Ann. Natal Mus., vi, p. 225, pl. xiv, f. 10–12. L.F.

The shell resembles that of the next species, crawfordi, in every respect, except that the umbilicus is even narrower and half-concealed by the slight columellar reflexion, and the sculpture of the protoconch is the same as on the later whorls, the fine, close, microscopic spiral lines extending into the apex.

The largest topotype in my collection contains nearly 5 whorls and measures

Diam. maj. 17.8, min. 15.5; alt. 11.0; apert. alt. 8.9, lat. 9.2 mm.

Hab. CAPE PROVINCE. Colesberg (type, Arnott); Middleton (Albert Reeve).

Type in British Museum.

The record of Biggarsberg, Natal (Miss Hickey), for an example in the Natal Museum is almost certainly incorrect.

Group 2. Apex microscopically punctate with dots arranged in regular radial and spiral lines.

#### Sheldonia crawfordi (M. & P.). Ref. List Nos. 136 and 139.

1890. Helix (Pella) crawfordi M. & P., A.M.N.H., vi, p. 469. D. 1892. ,, ,, ,, ,, ix, p. 94, pl. iv, f. 4. F.

1892. Helix (Pella) minythodes M. & P., A.M.N.H., x, p. 240, pl. xiii, f. 8. D.F.

Shell of fair size, depressed globose, umbilicate, thin, smooth, dull, transparent, corneous brownish yellow. Spire not much exserted, apex obtuse. Whorls 5½, not very convex, regularly increasing, rounded at the periphery, protoconch, 1¼ whorls, sculptured with extremely close and fine microscopic punctate dots, arranged in regular spiral and radial lines, remainder covered with extremely close, fine, faint, microscopic transverse striolae, cut on the upper surface and for some distance below the periphery by equally fine and faint spiral lines, which appear to be absent from the base, due, perhaps, to weathering, and produce, where present, a most minute microscopic granulation under 20-fold magnification on fresh specimens; suture simple, shallow. Aperture obliquely ¾-lunate, labrum straight and receding slightly in profile, columella short, concave, in basal aspect forming a pronounced angulation, above which the margin is narrowly triangularly reflexed, but scarcely overhangs the narrow umbilicus.

Diam. maj. 17.8, min. 16.9; alt. 11.6; apert. alt. 8.6, lat. 9.2 mm.

H. minythodes was founded on a singleton collected by Crawford at Craigie Burn, Somerset East, from which district crawfordi is recorded below; it contains 4 whorls, measures  $10.8 \times 9.0$ , alt. 6.7, apert. alt.

5.6, lat. 5.3 mm., and is simply a half-grown shell of that species, with which it agrees in every detail; the columellar angulation is pronounced (although omitted from the original description), but that feature is rather variable in individuals of this species, and may in this case be due to immaturity.

Hab. CAPE PROVINCE. Port Elizabeth (type, Crawford, fide M. & P.), Middleton; Kleinpoort, Graaff Reinet Line (Crawford); Cradock (Farquhar); Groot River Vlei, Zwagershoek (Mrs. Howard); Witmoss (Reeve); Somerset East (in S.A. Museum); Doorn R., N. of Montagu Pass, between George and Oudtshorn (Haughton).

Both types in British Museum; description of shell in my collection.

#### Sheldonia caledonensis (G.-Aust.).

Ref. List No. 158.

1912. Peltatus caledonensis G.-Aust., A.M.N.H., ix, p. 132, pl. ii, f. 1; pl. iv, f. 3; pl. v, f. 1. D.A.R.

Similar to crawfordi in form, colour, and sculpture, the fine microscopic granulation extending all over the base, but the shell is imperforate at all stages of growth. My largest paratype contains  $4\frac{1}{2}$  moderately convex whorls and measures Diam. maj. 14·1, min. 12·3; alt. 9·6; apert. alt. 7·7, lat. 7·9 mm.

Hab. CAPE PROVINCE. Houw Hoek (type, Connolly); Hills behind Hermanus, 200–500 feet (Rennie).

Type in British Museum.

The animal and anatomy are fully described by Austen, who states that it is a typical Peltatus and that the radula formula is 58+2+9+1+9+2+58; the marginals are all bicuspid, nearly equally so, becoming more even as they approach the margin, the outermost 3 very small, with from 3 to 4 cusps.

# Sheldonia phytostylus (Bs.).

Ref. List No. 164.

1864. Helix phytostylus Bs., A.M.N.H., xiii, p. 492. D. 1934. ,, ,, Watson, Proc. Mal. Soc., xxi, p. 190. N.

Shell of fair size, depressed globose, imperforate, thin, silky, semi-transparent, corneous reddish brown, though dulled and streaked with grey except in very fresh specimens. Spire moderately exserted, sides straight, summit obtusely conical. Whorls 5, moderately convex, regularly increasing, rounded at the periphery, sculpture exactly the same as in crawfordi on mature shells, but the same on base as on upper surface in half-grown ones; suture simple, well defined. Aperture and labrum as in crawfordi, columella erect, unreflexed, upper end inclined to the left at a strong obtuse angle  $1\cdot 2$  mm. before junction with the paries.

Diam. maj. 18·0, min. 15·5; alt. 13·4; apert. alt. 9·8, lat. 8·5 mm.

Hab. CAPE PROVINCE. Colesberg (type, Arnott); Riversdale (Mrs. Hudson); Port Elizabeth (Crawford); Mossel Bay and district (Power; Barnard).

Type in British Museum.

Shell described from Mossel Bay in my collection.

A higher form than *crawfordi*, and whereas in that species the slight angulation at the upper end of the columella encircles the umbilicus, *phytostylus* is always imperforate, and readily distinguished by this remarkable angulation from any other African shell.

### Sheldonia asthenes (M. & P.). Ref. List No. 157.

1907. Helicarion asthenes M. & P., A.M.N.H., xix, p. 99, pl. vi, f. 10. D.F.

Shell of fair size, subdepressed globose, minutely rimate, thin, smooth, dull above, less so beneath, transparent, pale corneous brown. Spire not much exserted, apex obtuse. Whorls 5, not very convex, rapidly increasing, rounded at the periphery, protoconch, 2 whorls, microscopically engraved almost to the apex, spirally and radially, with lines of very close, moderately coarse, punctate dots, remainder showing extremely fine, close transverse striclation, crossed on the upper surface by equally close microscopic spiral lines, which are, however, so fine and faint as to be hardly visible under 20-fold magnification and are practically negligible; suture simple, rather deep. Aperture sublunate, labrum receding gradually to the base, columella short, margin extremely narrowly reflexed over the minute rima.

Diam. maj. (type) 19.8, min. 16.7; alt. 13.2; apert. alt. 10.7, lat. 11.3 mm.

Hab. CAPE PROVINCE. Cradock (type, Farquhar); Meirings Poort Berg, Prince Albert, 6500 feet (Barnard).

Type in British Museum.

A fine species, with apical punctation rather coarser than in most of the sub-genus.

## Sheldonia aloicola (M. & P.). Ref. List Nos. 155, 161 (pars).

1890. Vitrina huttoniae Bs., var. rufofilosa M. & P., A.M.N.H., vi, p. 467. D.

1890. Vitrina huttoniae Bs., var. meridionalis M. & P., A.M.N.H., vi, p. 468. D.

1890. Vitrina huttoniae Bs., var. aloicola M. & P., A.M.N.H., vi, p. 468. D.

1908. Peltatus hudsoniae Bs., G.-Aust., A.M.N.H., i, p. 131, pl. viii, f. 1. D.F.A.

1912. Peltatus hudsoniae Bs., G.-Aust., A.M.N.H., ix, p. 569. N. 1912. ,, aloicolor M. & P., G.-Aust., ibid., p. 131. A.R.

Shell of moderate size, depressed globose, imperforate, thin, rather glossy, transparent, corneous brownish yellow. Spire not much exserted, apex broadly rounded. Whorls 4, convex, rather rapidly increasing, protoconch,  $1\frac{3}{4}$  whorl, engraved with small, very close and fine microscopic dots, arranged in regular radial and spiral lines, remainder bearing only weak, slightly curved growth wrinkles; suture simple, well defined. Aperture  $\frac{7}{8}$ -lunar, labrum receding regularly, columella simple, very short.

Diam. maj. (type) 15.5, min. 12.0; alt. 11.0; apert. alt. 8.9, lat. 9.1 mm.

Hab. CAPE PROVINCE. Port Elizabeth, North End and Rufane Vale (aloicola), Rufane Vale (rufofilosa), North End (meridionalis, Crawford); Port Alfred (Tyson).

Types of aloicola and meridionalis in British Museum; rufofilosa ubi?. It would be a pity to change the appropriate name of this common species, though I fear that its retention is open to question. M. & P.'s three varieties of Vitrina huttoniae (a misspelling of hudsoniae) are not varietally separable, simply representing three stages of preservation in the same species. Var. rufofilosa, which has page priority, is badly named, being described from shells in which the liver, having broken during extraction of the animal, left a red line in the suture, a frequent occurrence in hyaline shells if not properly cleaned; the type set is not forthcoming and I am unaware of any other specimens. Var. meridionalis, next in order of precedence, represents immature shells of the other two forms, in fresher condition; it is stated to increase less rapidly than aloicola, but this is not the case, as the last whorl is the same width as in aloicola at the same stage of growth.

Var. aloicola is properly described from mature shells, and has the advantage of its anatomy being known and made the basis of the genus *Peltatus*; the recommendation of the International Committee (1905) runs: "In absence of any previous revision, the establishment of precedence by the following method is recommended:—

"(c) Other things being equal, that name is to be preferred which stands first in the publication (page precedence)," but in the present case it may, I think, be maintained that other things are not equal, and that aloicola, which has already been raised to specific rank by Godwin-Austen, shall retain precedence over the other two badly chosen names.

Under the name of *hudsoniae* Bs., Austen (1908) described the anatomy of a poorly preserved animal extracted from the type set of *aloicola* as the monotype of his new genus *Peltatus*, but he admitted subsequently that, owing to poor condition, much of his diagnosis

was inaccurate; in 1912, however (A.M.N.H., ix, p. 130, etc.), under the name of *Peltatus aloicola* var., he gave an exhaustive account of the anatomy of animals from Grahamstown, of which the shells do not correspond with those from the south coast, and appear to me to be far nearer to *S. hewitti* Conn., whereunder fuller details will be found.

# Sheldonia lightfooti sp. n.

(Pl. v, f. 1-4, and text-fig. 12.)

1914. Kerkophorus sp? G.-Aust., A.M.N.H., xiii, p. 470. A.R.

Shell rather small, subglobose, most minutely rimate, thin, glossy, transparent, pale corneous yellow. Spire not much exserted, apex obtuse. Whorls 4, moderately convey protecouch 11 whorl engaged

ately convex, protoconch,  $1\frac{1}{2}$  whorl, engraved with minute microscopic dots in radial and spiral lines, so close as to appear almost spirally coalescent, remainder practically smooth but for very weak growth wrinkles; suture well defined. Aperture  $\frac{3}{4}$ -lunar, labrum receding regularly, columella short, erect, margin so narrowly reflexed as hardly to admit of rimation.

Diam. maj.  $12\cdot0$ , min.  $9\cdot5$ ; alt.  $9\cdot0$ ; apert. alt.  $7\cdot7$ , lat.  $7\cdot0$  mm.; a larger example with a trifle over 4 whorls is  $14\cdot0\times11\cdot6$ , alt.  $10\cdot4$ , apert.  $9\cdot3\times8\cdot3$  mm.

Hab. CAPE PROVINCE. East London (Lightfoot).

Type in British Museum.



Text-fig. 12.—Sheldonia lightfooti Conn., East London. Jaw; ×13, and representative teeth from radula; ×200.

Radula formula  $(78+1+78)\times 106$ ; the change from laterals to marginals takes place rapidly about line 13; outer marginals rudimentary.

The shell resembles very closely that of *aloicola*, but may be a trifle more globose and glossy; Lightfoot collected a number of examples suspended by mucous threads from the branches of shrubs, in the course of an early morning stroll in East London Park.

# Sheldonia hudsoniae (Bs.).

Ref. List No. 161.

1864. Helix hudsoniae Bs., A.M.N.H., xiii, p. 493. D.

1890. Vitrina huttoniae Bs., M. & P., A.M.N.H., vi, pp. 467, 468. (Err. typ.)

Only differs from *aloicola* in apical sculpture, wherein the minute dots are placed so close together as to form almost continuous spiral lines. An example in my collection from Swellendam measures

Diam. maj. 15.0, min. 13.1; alt. 9.9; apert. alt. 9.0, lat. 9.0 mm.

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Hab. CAPE PROVINCE. Riversdale (type, Mrs. Hudson); Swellendam Mountains (Lawrence & Hesse).

Presumed type in British Museum.

#### Sheldonia hewitti Conn.

1912. Peltatus aloicola M. & P., var., G.-Aust., A.M.N.H., p. 130, pl. iv, f. 1. A.R. (?).

1929. Sheldonia hewitti Conn., Ann. Natal Mus., vi, p. 226, pl. xiv, f. 13–15. D.F.R.

Imperforate; 4 whorls, the apical  $1\frac{3}{4}$  engraved with very close microscopic spiral and radial dotted lines, remainder sculptured above and below with very faint, rather irregular transverse striae and growth lines.

Diam. maj. (type) 14.6, min. 12.1; alt. 11.0; apert. alt. 8.2, lat. 9.3 mm.

Hab. CAPE PROVINCE. Kabeljaauws, near mouth of Gamtoos R. (type, Hewitt); Grahamstown (?) (Farquhar).

Type in Albany Museum, Grahamstown.

Radula with 93+n rows, formula 84+1+84; a few lines near extreme margin slightly serrate.

Very near the three preceding species, but apparently of more glossy texture; more highly spired than hudsoniae and with whorls increasing very slightly more slowly than in aloicola, which it resembles closely in apical sculpture, but in that species the spiral lines, owing to the extreme closeness of the dots in them, are more apparent than the rays, while in hewitti the latter, due perhaps to the dots being infinitesimally farther apart, are more apparent than the spirals. This feature is in agreement with the Grahamstown race wrongly ascribed by Austen in 1912 to aloicola, while the shells are also in close accord, but here again hewitti appears to possess rather more glossy texture; study of the anatomy will determine their exact relationship.

# Sheldonia natalensis (Pfr.).

#### Ref. List No. 162.

1846. Helix natalensis Pfr., Symb., iii, p. 65. D.

1912. *Peltatus* ,, ,, G.-Aust., A.M.N.H., ix, p. 136, pl. iii, f. 2; pl. vi, f. 2. *D.F.A.R*.

1933. Sheldonia natalensis Pfr., Pilsb. & Ckll., P.Z.S., p. 365. Err. Loc.

Shell of moderate size, globose, scarcely perforate, smooth, dull above, less so beneath, translucent, pale corneous flesh, with close, fairly regular, narrow transverse chestnut strigae. Spire exserted, nearly rectangular, apex bluntly rounded.

Whorls 4, rather eonvex, rather rapidly increasing, protoconch, 2 whorls, microseopically engraved to the apex with radial and spiral lines of faint, close dots, the latter continuing as extremely faint lines on the upper surface of the later whorls but absent from the base, transverse sculpture consisting of weak growth wrinkles. Aperture sublunate, labrum descending rather steeply, gently recurved to the base, columella slightly concave, nearly erect, margin slightly thickened at top, but not reflexed.

Diam. maj. 16.4, min. 13.0; alt. 14.2; apert. alt. 9.9, lat. 9.1 mm.

The specimen described, in the British Museum, has been compared with the type, and is that of which the animal was dissected by Austen.

Hab. NATAL. Port Natal (Menke, fide Pfeiffer); The Bluff, Durban (fide Pilsb. & Ckll.).

CAPE PROVINCE. Port Elizabeth (Crawford, Farquhar); Grahamstown (Hewitt); Doorn R., north, of Montagu Pass, between George and Oudtshorn (Haughton).

Type in Stettin Museum.

Typically, this species is remarkable for its narrow transverse striping, but this pattern is not universal, as fresh, immature shells are sometimes uniform pale corneous yellow.

The anatomy is described by Austen, who states that the radula formula is 56+1+10+1+10+1+56, the central and lateral teeth as in "aloicola var." (hewitti?) and other Cape species, transition tooth similar, but on a narrower basal plate, outer marginals unevenly bicuspid and diminishing gradually to the edge, where they become very minute.

Pilsbry kindly informs me that the 1933 record of this species from Durban is a slip of the pen for K. natalensis (Krs.). It is doubtful whether Sheldonia s.s. really extends into Natal.

# Sheldonia cotyledonis (Bs.).

Ref. List No. 160.

1850. Helix cotyledonis Bs., A.M.N.H., v, p. 216. D.

" G.-Aust., A.M.N.H., ix, p. 134. A.R. 1912. Peltatus

Shell of fair size, subdepressed globose, imperforate, thin, dull, transparent, creamy fawn, with one broad infrasutural and one peripheral band of deep ehestnut, and base of same colour. Spire moderately exserted, apex bluntly rounded. Whorls 5, moderately convex, rounded at the periphery, regularly increasing, protoconeh, 2 whorls, microseopieally engraved with radial and spiral lines of elose, fine dots, remainder of upper surface showing the usual close, fine, microscopic spiral lineation, which is practically invisible on the base, where there is a scratchy irregular pitting in a spiral direction; transverse sculpture on the last 2 whorls consists of close, weak, regular, eurved striolae; suture simple, shallow. Aperture <sup>3</sup>/<sub>4</sub>-lunate, peristome simple, acute, labrum receding regularly to the base, columella short, margin adnately thickened and somewhat contorted.

Diam. maj. 17-2, min. 15-5; alt. 12-7; apert. alt. 8-4, lat. 8-6 mm.

Hab. CAPE PENINSULA. Simonstown (type, Benson); Kalk Bay (Layard); Kommetje; Buffelsfontein (Connolly).

CAPE PROVINCE. Fish Hoek; Hermanus; Saldanha Bay and Stumpnose, Malmesbury District (Lightfoot); Gorge of Salt R., Windhoek, Bredasdorp District (Rennie).

Specimens ex auct. in Cambridge Museum; description of shell from Kommetje in my collection.

The breadth of banding varies greatly, but appears to be constant in pattern, and renders this conspicuous species easily recognisable among its confrères.

The animal is orange-brown, pure orange beneath, right shell-lobe finely pointed and left small, both given off from a broad base; left dorsal lobe divided into 2 narrow parts. Radula formula 50+3+9+1+9+3+50, form of teeth as in the genus, marginals bicuspid, inner cusp slightly the longer, outermost teeth more evenly bicuspid.

Sub-genus Kerkophorus G.-Aust., 1912 (A.M.N.H., ix, p. 127).

Type  $Zingis\ inuncta$  M. & P.

(= Microkerkus G.-Aust., 1912, type H. symmetrica Crvn.).

Shell medium to rather small, depressed- or subglobose, smooth, very glossy, apical whorls practically smooth but for extremely fine, faint, close microspiral lines, remainder weakly growth-lined, with or without faint, close, microscopic spiral lineation, corneous brown or yellow, unicoloured or with a single superperipheral chestnut band.

Whereas in *Sheldonia* s.s. there appears to be a basis for its segregation on account of the stronger sculpture of the apical whorls, *Kerkophorus* and *Microkerkus* were differentiated by the length of the caudal lobe, which their author admitted might vary according to their state of preservation; I agree fully therefore with Watson's action (1934) in uniting the two sub-genera.

Since the actual dimensions throughout the genus appear to differ very little in proportion, it is possible to divide the shells of this sub-genus into two clear groups:

(i) Group of subcornea (Prest.): Shell subglobose, aperture more high than broad, sculpture usually showing microscopic spiral lines; shell lobes usually lengthened and narrow.

# Sheldonia subcornea (Prest.).

Ref. List No. 173.

1848. Vitrina natalensis Krs., Südafr. Moll., p. 74, pl. iv, f. 17. D.F.

1909. Helicarion subcornea Prest., A.M.N.H., iv, p. 498. D.F.

1912. Kerkophorus ampliatus M. & P., G.-Aust., A.M.N.H., ix, pl. xv, f. 1. A.

1914. Kerkophorus natalensis Krs., G.-Aust., A.M.N.H., xiii, pp. 451, 452, N; 453, Emend.; 454-459, pl. xx, f. 2.

Shell of good size, globose, most narrowly perforate, thin, smooth, glossy, transparent, pale corneous yellow-brown, sometimes with a narrow chestnut band just above the periphery, but usually unbanded. Spire moderately elevated, apex obtuse. Whorls 43, very rapidly increasing, moderately convex, rounded at the periphery, protoconch practically smooth, remainder sculptured with exceedingly weak, irregular growth wrinkles, and on the upper surface of the later whorls extremely close, faint, and fine microscopic spiral lines; suture simple, shallow. Aperture lunate, peristome simple, labrum receding in a curve to the rounded base, columella weak, concave, inclined to the left, upper margin most narrowly reflexed, forming a minute rima.

Diam. maj. 18.5, min. 15.0; alt. 13.0; apert. alt. 11.8, lat. 10.3 mm.

Hab. NATAL (subcornea, fide Preston). Natal Bay (natalensis, Krauss); Equeefa and Pietermaritzburg? (Burnup, fide Austen).

Type of natalensis in Stuttgart, subcornea in British Museum.

I omit details of the anatomy, as it is very doubtful whether either of the animals dubiously referred by Austen to natalensis really represented this species. While fairly frequent in old collections, it does not appear to have been gathered recently in its typical form, and may possibly have been subject to certain modification owing to the altered environment of the Durban district in the course of the last eighty years. On the other hand, poeppigii, cornea, and ampliata have undergone no alteration whatever since the days of Krauss, so it is possible that the present species still exists and only awaits rediscovery.

Since Kerkophorus appears to be merely a sub-genus of Sheldonia, Preston's name subcornea for the present species must replace natalensis Krs., which is preoccupied by S. natalensis (Pfr.).

# Sheldonia cingulata (M. & P.).

Ref. List No. 167.

1890. Vitrina cingulata M. & P., A.M.N.H., vi, p. 466. D. 1892. ix, p. 94, pl. v, f. 8. F. . ,,

Similar in form, sculpture, marking, and minute rimation to the banded form of subcornea, but the ground colour is deep lemon-yellow, and the girdle, which is chocolate, perhaps a little broader and stronger; I have not seen an unbanded example. The type contains  $4\frac{3}{4}$  whorls and measures

Diam. maj. 17.0, min. 14.0; alt. 13.0; apert. alt. 10.4, lat. 9.1 mm.

Hab. CAPE PROVINCE. Bellevue and Tootabi, near Alicedale; Alexandria District (type, Crawford); Bedford (Farquhar); Port St. John's (Shortridge); Kentani (Miss Pegler); East London (Rattray); Keurbooms R. bush (Barnard).

Type in British Museum.

# Sheldonia poeppigii (Pfr.).

Ref. List No. 175.

1846. Vitrina poeppigii Mke., Pfr., Symb., iii, p. 81. D.

1854. " " " " Conch. Cab., p. 17, pl. ii, f. 13-15. D.F.

1912. Kerkophorus (?) sp., G.-Aust., A.M.N.H., ix, pl. ii, f. 3. A.

1912. ,, poeppigi Mke. (?), G.-Aust., A.M.N.H., ix, pl. xii, f. 1. A.

1914. Kerkophorus poeppigi Mke., G.-Aust., A.M.N.H., xiii, pp. 453, 454. D.A.R.

1925. Kerkophorus poeppigi Mke., Conn., Trans. R. Soc. S. Africa, xii, p. 126. N.L.

The shell resembles that of cingulata very closely, but does not appear to attain the same size, is slightly more globose, and the microspiral lineation extends over the base. The type is banded, but the unbanded form is equally frequent, or more so, in the same colonies. The largest example from Uisidorn in my collection contains  $4\frac{1}{2}$  whorls and measures

Diam. maj. 15·1, min. 12·9; alt. 11·8; apert. alt. 10·0, lat. 8·5 mm.; but an immature member of the same series with 4 whorls is  $11 \times 9\frac{1}{2}$  mm. in diameter and 7 in height, thus corresponding within  $\frac{1}{2}$  mm. to the dimensions of Pfeiffer's type.

Hab. NATAL. Port Natal (Menke); on plants, widely distributed (Krauss); Uisidorn; Pietermaritzburg; Pinetown (Burnup).

CAPE PROVINCE. Port St. John's (Power).

ZULULAND. Mfongosi (Jones).

TRANSVAAL. Mooi River (fide Craven).

LORENZO MARQUES. Rikatla (fide Junod).

Type in Stettin Museum.

Animals from Pinetown and Uisidorn (Thornybush) were examined by Austen and appeared to be conspecific; a Pinetown example had the radula formula 52+3+8+1+8+3+52, central teeth rather small, marginals bicuspid, while among the minute teeth towards the extreme margin one here and there is tricuspid.

# Sheldonia ampliata (M. & P.).

Ref. List No. 166.

1899. Zingis ampliata M. & P., A.M.N.H., iv, p. 196, pl. iii, f. 5. D.F.

1914. Kerkophorus ampliatus M. & P., G.-Aust., A.M.N.H., xiii, p. 463. D.A.R.

In fresh condition the shell is bright, almost dark brown in colour; it agrees in sculpture and all other respects with the unbanded form of *subcornea*. The type measures

Diam. maj. 16·1, min. 13·2; alt. 12·0; apert. alt. 10·5, lat. 9·1 mm.

Hab. NATAL. Stella Bush, Durban (type, Burnup; Puzey); Port Natal (Wahlberg).

Type in British Museum.

A topotype dissected by Austen had the radula formula 70+2+15+1+15+2+70, central and laterals as usual in the genus, marginals aculeate, becoming very minute at the edge.

# Sheldonia zonamydra (M. & P.).

Ref. List No. 177.

1890. Vitrina zonamydra M. & P., A.M.N.H., vi, p. 467. D.
1892. ,, ,, ix, p. 94, pl. v, f. 9.
F.

1914. Kerkophorus zonamydrus M. & P., G.-Aust., A.M.N.H., xiii, pp. 465, 466, f. 2. D.A.R.

The type agrees in all characters with ampliata and the unbanded form of subcornea, except that the perforation is a little less minute, owing to the slightly more open reflexion of the columellar margin; it is dull corneous yellow, and measures

Diam. maj. 17.0, min. 14.7; alt. 13.0; apert. alt. 10.0, lat. 9.5 mm.

Hab. CAPE PROVINCE. Alexandria District (type, Crawford); Kowie (Farquhar); Port St. John's (Puzey); Keurbooms R. bush (Barnard).

NATAL. Durban (Penther, fide Sturany).

Type in British Museum.

If this is a valid species, Sturany's record is probably erroneous, while a record of *ampliata* from Port Elizabeth, given by Haas, is more likely to refer to *zonamydra*.

The Kowie shells are in rather fresher condition and darker yellowbrown in colour, while one bears an extremely faint, narrow rufous band; the largest measures 19 mm. in major diameter and 15.4 in altitude.

Austen has given details of the anatomy of one of the Kowie set, stating that it differs in some respects from others of the genus known to him, while the radula is peculiar, marginals short, slightly curving, unevenly bicuspid, outer cusp much below the inner; formula 80-100+3+15+1+15+3+80-100.

# Sheldonia russofulgens (M. & P.).

Ref. List No. 148.

1909. Helicarion russofulgens M. & P., A.M.N.H., iv, p. 490, pl. viii, f. 12. D.F.

A small globular shell with the form and sculpture of *ampliata*, but paler yellow in colour with a very narrow pale red superperipheral band. The type contains 4 whorls and measures

Diam. maj. 11.5, min. 9.3; alt. 8.0; apert. alt. 6.5, lat. 6.5 mm.

Hab. ZULULAND. Eshowe (type, Lady Saunders).

NATAL. Tongaat (fide Burnup); Hilton Road (fide M. & P.). Type in British Museum.

# Sheldonia vitalis (M. & P.).

Ref. List No. 176.

1908. Helicarion vitalis M. & P., A.M.N.H., i, p. 133, pl. vii, f. 4. D.F.

1912. Kerkophorus vitalis M. & P., G.-Aust., A.M.N.H., ix, pp. 138, 575, pl. iii, f. 3; pl. xv, f. 2. D.A.R.

The shell is uniform pale corneous yellow, paler at the apex, very smooth and glossy, with extremely weak growth striolae and no spiral sculpture. The type contains 4 whorls and measures.

Diam. maj. 15·3, min. 13·0; alt. 11·3; apert. alt. 9·0, lat. 8·6 mm.

Hab. NATAL. Port Shepstone (type); Durban (Burnup). CAPE PROVINCE. Port St. John's (?) (Power).

Type in British Museum.

Austen states that the generative organs compare closely with those of phaedima M. & P. The radula has more teeth in the row than any other species of the genus known to him, with formula 126+1+12+1+12+1+126, and is also remarkable by the marginal teeth being finely serrated on the outer edge, beginning with the 13th and continuing throughout.

A trio from Port St. John's is perfectly vitreous, more fragile, and apparently higher in spire than Port Shepstone examples; it is inadvisable, however, to deal further with them on such scanty material.

#### Sheldonia burnupi (G.-Aust.).

1912. Kerkophorus sp. n. (?) G.-Aust., A.M.N.H., ix, pl. ii, f. 2. A. 1912. ,, burnupi ,, ,, pp. 580, 581. N.

1914. Kerkophorus burnupi G.-Aust., A.M.N.H., xiii, p. 467, pl. xx, f. 1. D.A.R.

Shell comparatively small, subglobose, imperforate, very thin, not very glossy, milky olivaceous. Whorls 4, convex, rapidly increasing, first  $1\frac{1}{3}$  void of transverse sculpture, but engraved with exceedingly fine and close microscopic spiral lines, remainder bearing weak, curved growth striae of irregular strength, while the apical sculpture continues on the upper surface but not the base; suture simple, well defined. Aperture  $\frac{3}{4}$ -lunate, labrum receding in a curve, columella short, erect, unreflexed. The largest topotype in my collection measures

Diam. maj. 11.6, min. 9.3; alt. 8.0; apert. alt. 6.2, lat. 6.1 mm.

Hab. NATAL. Pietermaritzburg (Burnup; Rump).

Type in British Museum.

A delicate little species, somewhat approaching *inuncta* in the slight, though much less marked, oleate appearance of its upper surface. Austen described the anatomy and states the radula formula to be 46+3+7+1+7+3+46.

# $Sheldonia\ transvaalensis\ ({\tt Crvn.}).$

Ref. List No. 149.

1880. Vitrina transvaalensis Crvn., P.Z.S., p. 615, pl. lvii, f. 3. D.F.

1914. ? Kerkophorus transvaalensis Crvn., G.-Aust., A.M.N.H., xiii, p. 470. A.R.

1934. Sheldonia transvaalensis Crvn., Watson, Proc. Mal. Soc., xxi, p. 189. A.

A rather globose little shell, imperforate, pale yellow, with 4 whorls, first  $1\frac{1}{2}$  quite smooth, remainder of upper surface sculptured with extremely fine and close microscopic spiral lines and extremely weak transverse growth wrinkles; base smooth.

Diam. maj. 10.0, min. 8.1; alt. 6.1; apert. alt. 5.9, lat. 5.8 mm.

Hab. TRANSVAAL. Lydenburg (type, Barrett).

NATAL. Majuba (Connolly); Game Pass (Burnup); Mont aux Sources (Warren).

Type in British Museum.

The smallest of the group of unicoloured pale golden shells, which comprises also vitalis, leucospira, pellicula, chrysoprasina, and pondoensis; Austen examined a young animal from Game Pass and states that it is distinct from anything known to him; the radula is of the usual form, marginals evenly bicuspid, formula 32+3+6+1+6+3+32.

# Sheldonia melvilli (G.-Aust.). (Pl. v. f. 5–6.)

1912. Kerkophorus melvilli G.-Aust., A.M.N.H., ix, pp. 127, 576, pl. vii, f. 1; pl. xiv, f. 2. D.A.R.

The shell corresponds in every detail with the unbanded form of *subcornea* except that it is of paler yellow colour; the microspiral lineation is just discernible on the apex of very fresh young shells, but disappears rapidly with age.

Diam. maj. (type) 17.0, min. 14.8; alt. 11.5; apert. alt. 9.3, lat. 8.3 mm.

Hab. NATAL. Equeefa (Burnup).

Type in British Museum.

The radula is similar to that of *inuncta* in having quite a number of aculeate marginals; these pass towards the margin, and at about the 35th tooth from the edge, into the bicuspid form, with the inner point the longer. The formula is about 80+3+13+1+13+3+80.

#### Sheldonia bicolor (G.-Aust.).

1912. Kerkophorus corneus Pfr., G.-Aust., A.M.N.H., ix, pl. i, f. 1. A. 1914. ,, bicolor G.-Aust., A.M.N.H., xiii, pp. 453, 460, 461, pl. xix, f. 1. D.A.R.

Shell small, minutely perforate, very glossy, upper surface pale reddish brown between suture and chestnut superperipheral band, and deep buff below it. Whorls 4, sculptured as in *poeppigii*, but the apical microspiral lineation is only plain on fresh young shells. The largest specimen in the Natal Museum measures Diam. maj. 13·4, min. 11·3; alt. 9·0; apert. alt. 8·0, lat. 7·8 mm.

Hab. NATAL. Town Bush, Pietermaritzburg (type, Burnup). CAPE PROVINCE. Hogsback, Amatola Mts. (Hewitt). Type in British Museum.

The anatomy is fully described by Austen, who states that the radula differs from all he had yet dissected, but approaches *inuncta*, central and laterals as usual, marginals long and curved, approaching the aculeate form, but all bicuspid, the outer cusp becoming notch-like and almost disappearing in the smaller teeth near the outer margin. Formula? 58+2+14+1+14+2+58?; jaw with no central projection.

The Hogsback shells agree in all externals, colour, form, and sculpture with the type set.

Sheldonia tongaatensis (G.-Aust.).

1914. Kerkophorus tongaatensis G.-Aust., A.M.N.H., xiii, p. 462. D.A.R.

The minutely perforate shell closely resembles that of *poeppigii*, but is slightly less globular; the colour is golden yellow, usually darker above than beneath, the type bearing a faint, narrow superperipheral band, which is, however, often lacking. Whorls 4, apical smooth, remainder sculptured with microspiral lineation, so faint and fine as to be scarcely discernible under high magnification.

Diam. maj. (type) 14.2, min. 12.0; alt. 9.3; apert. alt. 8.5, lat. 8.1 mm.

Hab. NATAL. Tongaat (Burnup).

Type in British Museum.

The darker shade of ground colour in this, as in other shells of the same character, is quickly evanescent, the original set now showing little of the rich coloration ascribed to them by Austen. The radula formula is (+36)+2+13+1+13+2+(36+), apparently similar to that of melvilli; the 2 transition teeth have the outer cusp higher than in the preceding tooth; in the next outer tooth the cusp is still nearer the point, and thence up to the margin is not seen at all, all being curved and aculeate in shape, becoming small and narrower nearing the margin, where a few show a bicuspid point.

# Sheldonia chrysoprasina (M. & P.). Ref. List No. 143.

1892. Vitrina chrysoprasina M. & P., A.M.N.H., x, p. 241, pl. xiii, f. 11. D.F.

1912. Microkerkus chrysoprasinus M. & P., G.-Aust., A.M.N.H., ix, p. 581. D.A.R.

Shell rather small, globose, rimate, thin, smooth, glossy, transparent, corneous yellow. Spire somewhat exserted, apex rounded. Whorls 4, convex, rather rapidly increasing, apex smooth, remainder sculptured with weak, irregular growth striae, which are weaker beneath, and extremely close microscopic spiral lineation on the upper surface of the last 2 whorls, faint traces being also visible on parts of the base; suture simple, well defined. Aperture  $\frac{5}{6}$ -lunate, peristome simple. acute, labrum recurved to the base, columella erect, margin narrowly reflexed, forming a small rima.

Diam. maj. (type) 11.0, min. 9.1; alt. 9.4; apert. alt. 7.0, lat. 6.3 mm.

Hab. CAPE PROVINCE. Cathcart (type, ex coll. Wotton). ORANGE FREE STATE. Thaba N'chu (Connolly). BASUTOLAND. Masite (Hewitt).

The type in British Museum is erroneously stated to come from Pretoria.

One of the most globose species and easily recognisable; the largest example from Thaba N'chu measures  $13\cdot2\times10\cdot2$  mm. in width and height. The anatomy is fully described by Austen, who states that the central and lateral teeth of the radula are rather longer than usual, the latter with a single basal cusp on the outer side; the 11th tooth rises higher, and the plate is much narrower at the 15th. Formula 56+10+1+10+56.

Sheldonia pondoensis (G.-Aust.).

(Text-fig. 13.)

Ref. List No. 178.

1912. *Microkerkus pondoensis* G.-Aust., A.M.N.H., ix, pp. 128, 580, pl. iv, f. 2; pl. xiv, f. 3. *D.A.R.* 

The type and only available example is very defective; there are 4 smooth, glossy whorls, the 2 apical white, remainder bright corneous yellow, sculpture



as in the foregoing species, but transverse striae slightly stronger and spiral apparently absent from the base; the spire is lower than in *chrysoprasina*.

Diam. maj. 12.0; alt. 8.5; apert. alt. 6.8 mm.

Text-fig. 13.—Sheldonia pondoensis (G.-Aust.), Kentani.

Hab. CAPE PROVINCE. Kentani (Miss Pegler).

Type, actual size.

Type in British Museum.

Austen states that "the lobe over the mucous pore is smaller than in other species, but the specimen examined is very much contracted in the spirit, so conclusions of this kind are not of great value."

Note.—The two next species are easily distinguishable from others of the group through the greater dullness of their upper surface.

Sheldonia symmetrica (Crvn.).

Ref. List No. 179.

1880. Helix symmetrica Crvn., P.Z.S., p. 614, pl. lvii, f. 2. D.F.

1912. Microkerkus symmetricus Crvn. (=concinnus G.-A. in litt.), G.-Aust., A.M.N.H., ix, pp. 128, 137, 570, 579, pl. i, f. 2; pl. iii, f. 4. D.F.A.R.N.

1914. Microkerkus symmetricus Crvn., G.-Aust., A.M.N.H., xiii, pl. xix, f. 2. A.R.

Shell of moderate size, subglobose, minutely perforate, thin, smooth, transparent, dull above, less so beneath, pale corneous brown. Spire moderately

exserted, apex bluntly rounded. Whorls 4, rather rapidly increasing, moderately convex, rounded at periphery, first practically smooth, remainder sculptured with extremely weak transverse striolae and, on the upper side, exceedingly close, fine and faint microspiral lines, which are only visible on fresh specimens and are absent from the base; suture simple, well defined. Aperture sublunate, labrum curved backward to the periphery, peristome simple, acute, columella concave, upper margin extremely narrowly reflexed, forming a minute rima.

Diam. maj. 15.7, min. 13.2; alt. 11.0; apert. alt. 8.8, lat. 8.3 mm.

Hab. TRANSVAAL. Lydenburg (type, Barrett); Pretoria (McBean; Connolly); Boksburg (concinnus, fide Austen).

Type in British Museum.

Animal and anatomy fully described by Austen, the generative organs, though generally like other species in the genus, differing in detail. Jaw much arched, with a central projection; radula formula 48+3+11+1+11+3+48, central and laterals as in the genus, outermost marginals with 2 or 3 serrations below the outer upper cusp.

#### Sub-species maseruensis (Conn.).

1929. Microkerkus symmetricus maseruensis Conn., Ann. Natal Mus., vi, p. 227, pl. xiv, f. 16-18. D.F.R.

1934. Sheldonia maseruensis Conn., Watson, Proc. Mal. Soc., xxi, p. 191. N.

Larger than the normal form, the type measuring Diam. maj. 20·0, min. 16·8; alt. 15·5; apert. alt. 11·0, lat. 11·9 mm.

Hab. BASUTOLAND. Maseru (type, Cottrell); Maluti Range, 6000-10,000 feet (S. C. Long); Masite (Hewitt).

Type in Albany Museum.

The radula formula varies from 70+10+1+10+70 to 75+11+1+11+75, a difference from that of the typical form which, together with the larger size, may justify subspecific distinction between them, though I hesitate to follow Watson in separating them specifically by comparison of the genital ducts of maseruensis with Austen's description of those of Craven's species.

## Sheldonia fuscicolor (M. & P.). Ref. List No. 169.

1892. Vitrina fuscicolor M. & P., A.M.N.H., x, p. 240, pl. xiii, f. 10. D.F.

1912. Kerkophorus fuscicolor M. & P., G.-Aust., A.M.N.H., ix, pp. 128, 584, pl. xvi, f. 2. Animal.

1914. Microkerkus fusicolor M. & P., G.-Aust., A.M.N.H., xiii, p. 471. A.R.

Shell large, subglobose, narrowly perforate, thin, smooth, transparent, dull above, less so beneath, corneous brown. Spire rather flat, apex bluntly rounded. Whorls 5, rapidly increasing, moderately convex, entire surface engraved to the apex with most extremely faint, fine, and close microspiral lines, which are almost invisible on the early whorls and base, and extremely weak growth striolae on the later whorls; suture simple, deep. Aperture sublunate, peristome simple, acute, labrum curved backwards, columella concave, upper margin extremely narrowly reflexed over the minute umbilicus. My largest specimen from Platberg measures Diam. maj. 24·5, min. 20·0; alt. 16·2; apert. alt. 13·3, lat. 13·0 mm.

Hab. ORANGE FREE STATE. Rensberg's Kop, Drakensberg (type, Quekett); Platberg, Harrismith (Connolly). National Park, Drakensberg, 11,000 feet (H. C. Wylde-Browne).

TRANSVAAL. Heidelberg (Connolly).

Type in British Museum.

By far the largest of the genus and easily distinguishable; it is of the same texture as symmetrica, but larger, with comparatively lower spire. In describing the animal, Austen says that the caudal lobe is small, jaw and radula as in the genus, formula 60+3+14+1+14+3+60, marginals unevenly bicuspid.

#### (ii) Group of cornea Pfr.

Shell vitriniform, depressed globose, usually very glossy, apex practically smooth, later whorls usually devoid of spiral sculpture; spire lower than in Group i, and aperture more broad than high; shell lobes usually large.

I select for the foundation of this group the oldest species, although the animal is not yet definitely fixed. The shell is fairly frequent in old collections, and I have received quite lately a typical recent example from Durban, so it probably still exists there in live condition, and will in any case take precedence of any species of later creation, if one be found to be anatomically conspecific with it.

> Sheldonia cornea (Pfr.). (Pl. ix, f. 26-28). Ref. List No. 168.

1846. Vitrina cornea Pfr., Symb., iii, p. 81. D.
1914. ,, ,, G.-Aust., A.M.N.H., xiii, pp. 451, 454.
N.D.

Shell of fair size, depressed globose, minutely perforate, very thin, smooth, glossy, transparent, pale corneous yellow, with a comparatively broad peripheral

chestnut band in the shell now described, but not in the type. Spire not greatly exserted, apex bluntly rounded. Whorls 4, flattish, rounded at the periphery, rapidly increasing, protoconch, 11 whorl, smooth, remainder sculptured with very weak, irregular growth wrinkles, and a few short, disconnected, irregular spiral scratches on the base; suture simple, shallow. Aperture sublunate, more broad than high, peristome simple, acute, columella weak, upper margin extremely narrowly reflexed, forming a minute rima.

Diam. maj. 15.5, min. 12.9; alt. 9.5; apert, alt. 8.3, lat. 9.5 mm.

Hab. NATAL. Port Natal (type, Menke); Durban (Puzey, 1930); Cape Natal (Plant, in British Museum).

CAPE PROVINCE. Eastern Province (fide Krauss); Elizabeth (fide Morelet).

Type in Stettin Museum; example described from Cape Natal corresponds within 1 mm. to all similar dimensions of the type.

## Sheldonia phaedima (M. & P.). Ref. List No. 174.

1892. Vitrina phaedima M. & P., A.M.N.H., x, p. 241, pl. xiii, f. 12. D.F.

1912. Kerkophorus phaedimus M. & P., G.-Aust., A.M.N.H., ix, pp. 139, 572, 573, pl. v, f. 3; pl. xiii, f. 1-10. D.A.R.

The shell agrees in all respects with that of cornea. The type, an unbanded example, was not mature, the largest topotype in my collection measuring Diam. maj. 14.4, min. 12.0; alt. 8.9; apert. alt. 7.2, lat. 8.3 mm.

The colour varies from yellow to pale olivaceous, and some of the darker examples have a narrow pale chestnut band, not quite so wide as is usual in cornea. The species appears to have a wide distribution; it is probably synonymous with cornea and extends into the Cape Province, whence it seems to have been redescribed under the name of that which follows.

Hab. NATAL. Pietermaritzburg (type); Durban; Pinetown; Dargle; Karkloof; Port Shepstone; Ntimbankulu (fide Burnup), but it is possible that some of these localities refer to species since segregated by Austen.

CAPE PROVINCE. Grahamstown; Bedford (Farguhar); Pirie Mountain (Godfrey); Keurbooms River bush (vel knysnaensis (?), Barnard).

Type in British Museum.

Animal very pale, with a long, narrow, keeled foot, indistinctly divided, and very long, arched tail-lobe; broad, large, pointed right and broad left shell lobe, which unite behind at the keel of the foot; right dorsal lobe small, left entire, covering the neck. Peripodial grooves indistinct. Penis with long, tapering, rather twisted flagellum, vas deferens joining near the base; epiphallus short; adjacent to the attachment of the retractor muscle is a fairly large free accessory gland; spermatheca an elongated thin sac at distal end of a thick strong tube. Free oviduct, just above base of spermatheca, a very dark pigmented globose sac, with smooth walls into which the oviduct leads; shaft of penis S-shaped.

Branchial cavity not extensive, pericardium and adjacent renal organ occupying a subcircular area next it, kidney short.

Spermatophore an elongate capsule, commencing a mass dark and pointed at one end, terminating in a long, gradually narrowing ribbon, having spines which generally branch into three, with bifid points set on its edge on one side only, and becoming very attenuate, and for some distance spineless, towards the end.

Jaw moderately concave, with a small central projection; radula with central tooth tricuspid, laterals with cusp on outer side, marginals long, beautifully curved and bicuspid, outermost showing pectination on outer side; formula 100+3+12+1+12+3+100.

I reproduce Austen's diagnosis of the anatomy almost in full, as there is no doubt that it refers to the species to which it is attributed and is taken from a really well-preserved animal.

#### Sheldonia knysnaensis (Prest.). Ref. List No. 145.

1912. Helicarion knysnaensis Prest., Proc. Mal. Soc., x, p. 16. D.F.

The shell agrees in all respects, even to the irregular pits or scratches on the base, with the paler, unbanded form of *phaedima*. A paratype in the British Museum measures

Diam. maj. 12.9, min. 10.4; alt. 8.0; apert. alt. 6.5, lat. 7.5 mm.

Hab. CAPE PROVINCE. Knysna (Cox).

Type in coll. Dautzenberg.

My sole reason for not uniting this species with the foregoing is lest subsequent knowledge of their anatomy should prove them to be distinct.

# Sheldonia perfragilis (Conn.).

1922. Kerkophorus perfragilis Conn., Proc. Mal. Soc., xv, p. 72, pl. ii, f. 4. D.F.

Shell extremely thin and fragile, very similar to *phaedima* but flatter, with proportionately greater major diameter and weaker sculpture. The type is pale

olivaceous with an almost invisible band of pale red, but darker examples may be found, the majority being unbanded. The type contains nearly 4 whorls and measures

Diam. maj. 15.5, min. 12.3; alt. 7.8; apert. alt. 7.5, lat. 8.9 mm.

Hab. TRANSVAAL. Shiluwane District (Junod). Type in British Museum.

### Sheldonia vandenbroeckii (Crvn.).

Ref. List No. 150.

1880. Vitrina vandenbroeckii Crvn., P.Z.S., p. 615, pl. lvii, f. 4. D.F.

The shell resembles *phaedima*, but all 5 specimens examined are smaller, *dull* above, though less so beneath, pale corneous buff. The type contains 3 rounded whorls, very rapidly increasing, protoconch, 2 whorls, smooth, remainder sculptured all over with weak, irregular growth striae.

Diam. maj. 13·1, min. 11·0; alt. 7·7; apert. alt. 6·9, lat. 8·5 mm.

Hab. TRANSVAAL. Lydenburg (Barrett).

Type in British Museum.

A distinct little species which awaits rediscovery, remarkable for its flat spire and dull surface.

#### Sheldonia inuncta (M. & P.).

Ref. List No. 170.

1860. Helix congellana Krs., Mts., Die Helic., p. 84. L. (nomen nudum).

1899. Zingis inuncta M. & P., A.M.N.H., iv, p. 195, pl. iii, f. 4. D.F.

1912. Kerkophorus inunctus M. & P., G.-Aust., A.M.N.H., ix, pp. 127, 138, 569, 571, pl. iii, f. 1; pl. xii, f. 2. D.F.A.R.N.

Shell of similar form to cornea, but larger, and remarkable from the fact that, while the first  $3\frac{1}{2}$  whorls are smooth and glossy, the last half-whorl, composing the greater part of the shell, is usually dull above, with a somewhat oiled appearance, though glossy on the base; the coloration is pale yellow-buff, with a narrow chestnut superperipheral band; there are 4 whorls, the sculpture consisting of extremely weak growth striolae, while on the base there is a certain amount of weak, irregular, discontinuous spiral scratching.

Diam. maj. (type) 22.7, min. 18.2; alt. 14.7; apert. alt. 11.7, lat. 12.7 mm.

Hab. NATAL. Umkomaas (type); Alexandra Junction (Burnup); "Port Natal, 40 miles south of Durban" (Dr. Sutherland, 1860); Wyebank (Puzey); Congella Lagoon (congellana, Wahlberg).

ZULULAND. 'Nkandhla Forest (Haygarth); Umbonambi (Toppin); Makowe (Crosly).

Type in British Museum.

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The oiled aspect of the last whorl is not always present, at least one example from Wyebank showing no trace thereof, when the shell somewhat resembles that of *subcornea* Preston.

Animal (from Alexandra Junction): Foot divided below, peripodial margin narrow, with the 2 usual grooves above, from which well-marked, widely separated furrows extend obliquely upwards; hinder part rounded above, not keeled; lobe above the linear mucous pore large and pointed; right shell lobe large and broad, left quadrate; dorsal lobes well developed, the left in two parts, posterior portion small; visceral sac and kidney spotted with black.

Generative organs similar to those of *phaedima*, except that the vestibule is large, globose, and solid, the thick walls having a rough, warty external appearance, while on the inner surface are seen about 4 strong, muscular, pillar-like folds. Free oviduct black, penis with accessory gland near retractor muscle; epiphallus very short; flagellum very long; spermatheca a large pear-shaped sac on a long solid duct.

Radula formula 60+1+15+1+15+1+60; central and laterals, latter with outer cusp, on large plates; 16th tooth transitional, with no cusp; succeeding marginals curved and aculeate up to about the 65th tooth, when a slight notch appears low down below the point on the outer side, gradually becoming higher up and larger; outermost marginals unevenly bicuspid. Jaw moderately curved, with a central projection on the cutting edge.

The aculeate form of the teeth in this species separates it well from its neighbours (Austen).

# Sheldonia leucospira (Pfr.).

Ref. List No. 171.

1856. Vitrina leucospira Pfr., P.Z.S., p. 326. D.

1912. Kerkophorus leucospira Pfr., G.-Aust., A.M.N.H., ix, p. 577, pl. xvi, f. 1; pl. xvii, f. 1–4. D.F.A.R.

The shell is minutely perforated; it resembles *subcornea* Prest, in sculpture, but there are faint traces of microscopic spiral lineation on the base; it is rather less globose and the colour of the first 3 whorls is milk white, the remainder being bright golden yellow. The largest African example in the British Museum contains 4 whorls and measures

Diam. maj. 15.4, min. 12.8; alt. 11.6; apert. alt. 9.0, lat. 9.2 mm.

Hab. NATAL. Pinetown; Tongaat; Malvern (Burnup); Umgeni River mouth (Quekett); Drummond (Rump).

The type in British Museum is said to come from Australia, but the record is almost certainly incorrect.

Austen gives very full details of the anatomy and states that the radula formula is 67+3+9+1+9+3+67; central and laterals with a basal cusp on the outer side, rather distant from the mesocone, marginals gradually becoming evenly bicuspid, and from about the 65th tooth distinctly serrated below the outer cusp.

### Sheldonia pellicula (Pfr.). Pfr. List No. 163.

1821. Helix (Helicolimax) pellicula Fér., Tabl. Syst., pt. 3, p. 25 (or 21). L.

1842. Vitrina pellicula Fér., Pfr., Symb., ii, p. 17. D.

Hab. CAPE OF GOOD HOPE, "on aloes" (type, Delalande); Port Elizabeth (fide Crawford).

CAPE NATAL and DELAGOA BAY (Plant, fide Pfeiffer, ex coll. Cuming in British Museum).

Type ubi?

As represented in the British Museum this species is identical with *leucospira*, but without knowledge of the type it is impossible to determine the truth concerning its identity.

#### Sheldonia stellata (G.-Aust.).

1914. Kerkophorus stellatus G.-Aust., A.M.N.H., xiii, p. 464. D.A.R.

Shell of fair size, minutely perforate, first  $2\frac{1}{2}$  whorls and base glossy, palest yellow, last  $1\frac{1}{2}$  somewhat dull milky olivaceous, thus resembling *inunctus*; 4 whorls, first 2 practically smooth, later showing exceedingly faint, fine, close microspiral lineation.

Diam. maj. 15.0, min. 12.6; alt. 10.3; apert. alt. 8.1, lat. 8.7 mm.

Hab. NATAL. Stella Bush, Durban (type, Bell Marley; Puzey). Type in British Museum.

The slightly milky appearance enables this species to be readily recognised. Austen states that the generative organs are the same as in the genus; radula of the type seen in *phaedima*, central and laterals as usual, marginals all alike, curved, with bicuspid points, the inner slightly the longer, and graduating into minute teeth on the margin, formula 97 + 2 + 11 + 1 + 11 + 2 + 97.

Sheldonia orientalis (G.-Aust.). (Pl. v, f. 7-9.)

1914. Kerkophorus orientalis G.-Aust., A.M.N.H., xiii, p. 468. D. Shell of moderate size, subglobose, minutely perforate, thin, transparent, rather ilky above and glossy beneath, pale buff. Spire not much exserted. Whorls 5,

milky above and glossy beneath, pale buff. Spire not much exserted. Whorls 5, rather flat, regularly increasing, first 2 or 3 smooth, remainder with most exceedingly fine and close microscopic spiral lines, and on the post-apical whorls weak, curved growth striolae. Aperture somewhat roundly barbate, nearly horizontal, columella short, margin very narrowly reflexed, forming a minute rima.

Diam. maj. (type) 13.9, min. 11.6; alt. 8.5; apert. alt. 7.0, lat. 8.0 mm.

Hab. CAPE PROVINCE. East London (Kincaid).

Type in British Museum.

The form of the shell is reminiscent of such as S. capsula (Bs.), but the spiral sculpture on the latter, though similar on the post-apical whorls, is far finer.

Sheldonia warreni sp. n.

(Pl. v, f. 10-11.)

Shell of good size, depressed globose, narrowly perforate, thin, smooth, glossy, transparent, pale corneous yellow. Spire but little exserted. Whorls 4, rapidly increasing, little convex, the only sculpture consisting of close, curved, transverse striolae on the later whorls, which are, however, at irregular intervals distinctly stronger than in *melvilli* or *inuncta*, the nearest allied species. Aperture short oval, columella erect, upper margin narrowly reflexed over the very narrow umbilicus. The type and two other examples measure

Diam. maj. 17.6, min. 13.7; alt. 12.4; apert. alt. 10.1, lat. 11.0 mm. , 16.4 ,, 13.0 ,, 11.8 ,, 9.5 ,, 10.2 ,, , 14.8 ,, 11.7 ,, 9.4 ,, 7.8 ,, 9.0 ,,

Hab. NATAL. Port Shepstone (Warren; Burnup).

Type in British Museum.

Eight examples, one of which bears an extremely faint and narrow peripheral band; all agree in the horizontal aperture which distinguishes the new species.

It gives me the greatest pleasure to be able to name it after its discoverer in recognition of his valuable service to South African science, and especially of the high standard attained, and maintained under his able editorship, by the Annals of the Natal Museum.

Sheldonia (?) planti (Pfr.).

(Text-fig. 14.)

Ref. List No. 146.

1856. Vitrina planti Pfr., P.Z.S., p. 324. D.

Shell small, subnautiloid, thin, smooth, glossy, transparent, corneous pale yellowish olivaceous. Spire flat. Whorls  $2\frac{1}{4}$ , nearly flat, rounded at the periphery,

very rapidly increasing, the last widening greatly towards the aperture and embracing nearly the entire shell; the sculpture consists of close, weak, regular. curved transverse striolae, which are weaker on the base; suture simple, well defined. Aperture oblong oval, peristome simple, acute, labrum strongly curved backward to the

periphery.

Diam. maj. (type) 13.2, min. 10.0; alt. ca. 6.0; apert. alt. ca. 6.0 mm.

Hab. NATAL. Cape Natal (Plant). Type in British Museum.



Text-fig. 14.—Sheldonia planti (Pfr.), Port Natal. Type, actual size.

The condition of all specimens available is too imperfect for specification of further details, but the flat spired shell, with its unusually long aperture, somewhat resembles the profile of a Nautilus; the species is probably extinct, and may not be congeneric with any other South African form, recalling rather such Central African species as Zonitarion semimembranaceus (Mts.).

### Sheldonia puzeyi sp. n. (Pl. v, f. 12-14.)

Shell comparatively large, depressed conic-globose, perforate, very thin, smooth, glossy, transparent, pale olivaceous yellow with an extremely narrow rufous band around the periphery. Spire moderately exserted, sides regular, scarcely convex, apical angle 113°. Whorls 6½, but little convex, regularly increasing, bluntly angulate at the periphery, sculptured on the apex, as in the genus, with extremely close microspiral lines, weaker on the succeeding whorls, which show extremely weak, curved oblique striolae; suture simple, shallow. Aperture subquadrate, peristome simple, acute, labrum gently and regularly recurved to the base, columella very short, erect, margin narrowly reflexed over the very narrow umbilicus. Diam. maj. 23.0, min. 20.2; alt. 15.3; apert. alt. 10.2, lat. 11.3 mm.

Hab. CAPE PROVINCE. Port St. John's (type, Puzey; Power). Type in British Museum.

A beautiful, though featureless shell, for which I should have proposed at least sub-generic rank were it not that in Sheldonia s.s. the variation in form ranges from the nearly globular trotteriana, through such as capsula and crawfordi, to the conoid cotyledonis, so that the new species may stand, in Kerkophorus, in the same position as the last mentioned in Sheldonia s.s.

> Sub-genus Andrarion G.-Aust., 1912 (A.M.N.H., ix, p. 582). Type Helicarion pumilio M. & P.

Shell small, flattened, of few whorls, the apical close wound and rapidly increasing. Animal with a broad, short right and a small triangular left shell lobe; generative organs unknown. Radula with central and lateral teeth of usual form, inner marginals bicuspid, becoming tricuspid about the 30th tooth, several thereafter having 4 cusps and showing a serrated edge.

Formula 45+2+9+1+9+2+45 or 56+1+56. Jaw with a central projection. (After Austen.)

### Sheldonia pumilio (M. & P.). Ref. List No. 147.

1909. Helicarion pumilio, M. & P., A.M.N.H., iv, p. 490, pl. viii, f. 11. D.F.

1912. Andrarion pumilio, M. & P., G.-Aust., A.M.N.H., ix, p. 582, pl. xvi, f. 3. D.A.R.

1934. Sheldonia pumilio, M. & P., Watson, Proc. Mal. Soc., xxi, p. 190. N.

Shell very small, depressed globose, most narrowly rimate, thin, smooth, rather glossy, semi-transparent, dull corneous yellow. Spire but little exserted, apex obtuse. Whorls  $2\frac{1}{2}$ , not very convex, rounded at the periphery, rapidly increasing, apex smoothly malleate, remainder sculptured all over with transverse striolae, a little less weak and more regular than in most of the smooth-shelled Sheldoniae; suture simple, well defined. Aperture suboval, peristome simple, acute, labrum curved backwards to the base, columella concave, margin narrowly reflexed, forming a small rima.

Diam. maj. (type) 6.8, min. 5.2; alt. 3.5; apert. alt. 2.9, lat. 3.7 mm.

Hab. TRANSVAAL. Zoutpansberg (Cregoe).

Type in British Museum.

This little species is only known from the original set; it might be considered an immature S. symmetrica, but the serrate teeth of the radula are not found in that animal, of which the shell and aperture are higher in proportion and the latter less broad; the lack-lustre surface of pumilio does not assimilate with the immature stage of others of the genus known to me and the shell may perhaps be nearly, if not quite, mature. Further knowledge of the anatomy is necessary before the status of Andrarion can be determined.

Genus Gudeëlla Preston, 1913
(Proc. Mal. Soc., x, p. 285).

Type Thapsia masukuensis Smith
(=Thapsiella Gude, 1911, non Fischer, 1884).

Most authorities include this large group of small, corneous, zonitiform snails as congeneric with the small group of large but similar

forms contained in the genus *Thapsia* Albers. However, the anatomy of neither group is yet fully known and it is certainly convenient to retain a distinguishing name for each pending further knowledge thereof, as the dividing line between the large and small forms is well marked.

The anatomy of Gudeëlla, so far as published, and chief characters of the shell are given below under G. pinguis; I follow Watson in placing this group, together with Thapsia, near Sheldonia, while "Zingis (?)," as exemplified by morrumbalensis M. & P., may be intermediate between the two.

> Gudeëlla pinquis (Krs.). (Pl. ii, f. 12-15, and text-fig. 15.) Ref. List Nos. 186, 265.

1848. Helix pinguis Krs., Südafr. Moll., p. 75, pl. iv, f. 19. D.F. 1899. Thapsia mixta Smith, P.Z.S., p. 582, pl. xxxiii, f. 13-15. D.F.

1903. Zonitoides cupido M. & P., A.M.N.H., xii, p. 601, pl. xxxii, f. 1. D.F.

1925. Gudeëlla mixta Smith, Conn., Trans. R. Soc. S. Africa, xii, p. 127. N.A.R.

Shell small, depressed globose, perforate, thin, smooth, glossy, transparent, pale corneous, rather lacteous on base. Spire not much elevated, though each whorl projects clearly above the next, apex obtusely rounded. Whorls 51, rounded, gradually and regularly increasing, covered all over with extremely fine and close, regular, microspiral lines, and from about the 3rd whorl with very faint, slightly irregular oblique striae, curved in conformity with the lines of growth; suture simple, shallow. Aperture sublunate, peristome simple, acute, labrum receding to the base, columellar margin narrowly reflexed but not covering the very narrow umbilicus. The type measures

Diam. maj. 7.6, min. 6.7; alt. 4.2; apert. alt. 2.6, lat. 3.8 mm.

Hab. NATAL (type, Wahlberg).

ZULULAND. Lower Umfolosi Drift (cupido, Burnup).

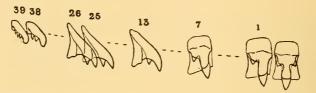
TRANSVAAL. Pepiti Falls, Sibasa (Harries).

LORENZO MARQUES. Tette (Peters); Macequece District; Dondo; Mtisherra R. Valley; Zangwe Basin (Cressy); Maforga Siding, B. & M. Rly. (McDowell).

S. RHODESIA. Victoria Falls (frequent).

Type of pinguis in Stuttgart, mixta and cupido in British Museum; mixta was described from Mt. Chiradzulu, Nyasaland, and the species appears to extend to Kenya and the Belgian Congo. As signified by Smith's name, it varies greatly in colour, pale brown, buff, or hyaline shells often occurring in company together, while the early whorls are sometimes buff and the later lacteous or hyaline in the same shell. G. pinguis was described from a brown example, cupido from a small hyaline series, while the type set of mixta includes all colours, as do assemblages from Victoria Falls, Macequece, and many parts of Central Africa. There was no authentic specimen of pinguis in England at the period when Smith and M. & P. described their species, but it is remarkable that the latter compared theirs with the American Z. arboreus, rather than sought for its affinities in the nearer districts of Africa; both mixta and cupido agree entirely with pinguis and pass into its synonymy.

The foot of the animal is narrow, ending in a pointed lobe overhanging the caudal mucous gland, which opens by a vertical slit;



Text-fig. 15.—Gudeëlla pinguis (Krs.) (=mixta Smith), Macequece. Representative teeth from radula;  $\times 600$ .

sole tripartite; the mantle edge bears 2 somewhat pointed shell lobes, the right rather narrow and the left smaller and somewhat triangular; well-developed body lobes also present, the left divided into 2 distinct, but contiguous portions, kidney yellow, rather narrow, about three times as long as pericardium, ureter arising from front end of kidney, running back along its upper edge and then forward again beside the rectum to the anus. Radula formula  $(31+10+1+10+30)\times 77$ , centrals and laterals tricuspid, their mesocones rather long, projecting considerably beyond the edges of the basal plates, endocones of laterals narrow and inconspicuous, attached laterally to mesocones, ectocones short but distinct, marginals narrow, about three times as numerous as laterals, with narrow bases and curved bifid cusps, which are composed of the mesocones and slightly shorter ectocones, while towards the edges of the radula they become smaller and shorter, mesocones blunter and ectocones split up into 2 or 3 separate small cusps.

#### Gudeëlla insimulans (Smith).

1899. Thapsia insimulans Smith, P.Z.S., p. 583, pl. xxxiii, f. 16-18. D.F.

Shell small, depressed turbinate, narrowly umbilicate, smooth, shining, transparent, pale corneous. Spire but little raised, though each whorl projects just above the next, apex obtuse. Whorls 41, narrowly rounded, gradually and regularly increasing, apical 14 smooth, remainder covered on both sides with very faint, close, somewhat irregular, curved transverse and microscopic spiral striae; suture simple, very narrow and shallow. Aperture flattened acuminate-subovate, peristome simple, acute, columellar margin very shortly and narrowly reflexed, umbilicus extremely narrow but deep, extending to the apex.

Diam. maj. 4.0, min. 3.5; alt. 2.2 mm.

Hab. LORENZO MARQUES. Headwaters of R. Inyamkarra, 4500 feet (Cressy); Maforga Siding, B. & M. Rly. (McDowell).

Described from Mt. Chiradzulu, Nyasaland, and recorded from Kenya and Oubangui.

Type in British Museum; shell described, from Macequece District, in my collection.

A flatter, more compact little species than the preceding.

Genus Zingis Mts., 1878 (Monats-Ber. K. Akad. Wiss. Berlin, p. 290). Type Z. radiolata Mts.

I omit the anatomy originally attributed to this genus, since Pfeffer's diagnosis is either faulty or relates to a form of very different affinities to those under present notice, my only reason for retaining the name here being to provide a temporary lodging for the following species, which have been placed in Zingis and may be left therein until anatomists have decided their true generic position.

> Zingis morrumbalensis (M. & P.). (Pl. ix, f. 32-33, and text-fig. 16.)

1894. Nanina morrumbalensis M. & P., A.M.N.H., xix, p. 90, pl. i, f. 1. D.F.

1925. Zingis morrumbalensis M. & P., Conn., Trans. R. Soc. S. Africa, xii, p. 129. N.A.R.

1934. Thapsia (?) morrumbalensis M. & P., Watson, Proc. Mal. Soc., xxi, p. 184. N.A.

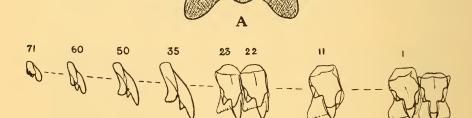
Shell large, depressed globose, umbilicate, thin, silky, transparent, somewhat dull above, glossy beneath, corneous yellow-brown. Spire moderately exserted. apex obtuse. Whorls 6, convex, rather rapidly increasing, rounded at the periphery in mature, but bluntly angulate in young examples, protoconch,  $2\frac{1}{2}$  whorls, apparently smooth and glossy, but sculptured almost to the apex with most exceedingly fine and close, regular, microscopic spiral lines, so faint as to be scarcely discernible under 20-fold magnification, remainder covered with coarse, weak, curved growth striae of irregular strength, much weaker on the base, and any traces of the apical sculpture so faint as to be negligible; suture simple, well defined. Aperture  $\frac{3}{4}$ -lunate, peristome simple, acute, labrum slightly curved and receding considerably in profile, columella short, concave, margin triangularly reflexed, half covering the narrow umbilicus.

Diam. maj. 30·4, min. 25·7; alt. 21·5; apert. alt. 16·9, lat. 15·6 mm.

Hab. LORENZO MARQUES. District north of Macequece (Cressy). RHODESIA. Mt. Silinda, Melsetta (Miss A. de Klerk); Vumbu Mts., Umtali (Arnold).

Originally described from Mt. Morrumbala, Mozambique (Layard); type in British Museum, foregoing description of specimen from Macequece in my collection.

The foot has well-marked peripodial grooves, tripartite sole and well-developed caudal mucous pore, overhung by a pointed lobe; right and left shell-lobes present, left body lobes contiguous but



Text-fig. 16.—Zingis morrumbalensis (M. and P.), Macequece.

B

A. Jaw;  $\times 9$ .

B. Representative teeth from the radula;  $\times 225$ .

separated by a slit; spermatheca large with a duct 17 mm. long, vagina short; epiphallus with a flagellum 8 mm. long at its junction with vas deferens, and a short, straight caecum, to the apex of which the penial retractor is attached; no distinct dart-sac; kidney extending for some distance in front of pericardium.

Jaw about  $3\cdot 3$  mm. in length, showing numerous extremely fine lines of growth crossed by equally fine radial striae. Radula measures about  $6\cdot 2\times 3\cdot 1$  mm.when flattened, formula  $(54+22+1+22+53)\times 128$ ;

central and lateral teeth tricuspid, marginals bicuspid, diminishing in size towards the edge, the last 4 or 5 quite vestigial; very full details are given in my paper of 1925.

I give the foregoing details at some length, as this species may well represent a new genus, which Watson suggests is intermediate between Thapsia Albers and Sheldonia Ancey; but I leave it in Zingis until its place may be fully decided by experts on anatomy; its group probably includes "Zingis" whytei (Smith) and an undescribed form from S. Rhodesia, of which material yet to hand does not justify description.

### Zingis thermarum M. & P.

Ref. List No. 142.

1909. Zingis thermarum M. & P., A.M.N.H., iv, p. 491, pl. viii, f. 14. D.F.

Shell of medium size, depressed orbicular, umbilicate, thin, smooth, rather dull, semi-transparent, corneous reddish or orange-brown. Spire depressed, summit obtuse. Whorls 5, not very convex, gradually increasing, bluntly angled at the periphery, extreme apex showing 5 or 6 short, strong, oblique wrinkles, after which the first 2 whorls are engraved with strong, close, regular, continuous spiral grooves, remainder sculptured with extremely weak growth wrinkles and a closer, fainter continuation of the spiral grooves, which are regular and gradually fade away on the upper surface, but continue and become remarkably fulgurate on the base; suture simple, well defined. Aperture obliquely sublunate, labrum straight and receding somewhat in profile, columella very short, margin little reflexed, not overhanging the narrow umbilicus.

Diam. maj. 16.0, min. 14.0; alt. 9.0; apert. alt. 7.4, lat. 7.3 mm.; a larger example, from Musami, with  $5\frac{1}{2}$  whorls, measures  $17.5 \times 11$  mm.

Hab. TRANSVAAL. Buiskop, Warmbaths (type); Pietpotgietersrust (Connolly).

S. RHODESIA. Musami; Driefontein, Umvuma (Rev. K. Tasman); Umtali (in S.A. Museum).

Type in British Museum, description from largest paratype in my collection.

The continuous microspiral grooving of the apical whorls, without faintest sign of punctation, appears to separate this species from Sheldonia s.s., which seems practically restricted to the Cape Province, but the radular features prove it nearly akin.

Zingis rosenbergi Prest.

Ref. List No. 141.

1909. Zingis rosenbergi Prest., A.M.N.H., iv, p. 498. D.F.

Shell slightly higher but otherwise agreeing entirely with the foregoing in form, thin, smooth, rather dull above, glossy beneath, opaque corneous yellow. Whorls

5, not very convex, regularly increasing, rounded at the periphery, somewhat weathered but apparently devoid of spiral sculpture, the first 3 sculptured, except at extreme apex, with microscopic growth wrinkles below the suture, extending for the most part less than half-way across the whorl, remainder bearing close, weak transverse striolae; suture simple, shallow. Aperture oblong oval, labrum receding a little to the base, columella inclined to the left, margin scarcely reflexed, so that the narrow umbilicus is almost open.

Diam. maj. (type) 15.6, min. 13.7; alt. 9.3; apert. alt. 6.5, lat. 7.8 mm.

Hab. TRANSVAAL. Pietersburg (fide Preston).

Type in British Museum.

The shell is considerably weathered and may be more transparent and of darker colour in fresher condition. It is placed next to thermarum on account of the close resemblance in form between the two, but the complete lack of spiral sculpture, unless due to weathering, probably denotes at least generic distinction.

#### Sub-Family Ledoulxhnae Pilsb., 1919.

Shell well developed, capable of containing the soft parts, not covered by shell lobes of mantle; tail with horn over caudal pore; genitalia without dart-sac or distinct vagina, penis surmounted by a group of glands; epiphallus bearing a caecum and a minute flagellum.

Genus *Ledoulxia* Bgt., 1885 (Helixarionidées, p. 12).

Type H. mozambicensis Pfr., var. albopicta Mts. (= Martensia Semper, 1870, non Agassiz, 1860).

Shell depressed conoid, usually angulate at periphery, sculptured above with very fine, close, clear oblique striae, base smoother, with more or less spiral grooving.

H. B. Baker (Nautilus, l, 1936, p. 70) points out that Mousson (J. de C., xvii, 1869, p. 330) in a discussion on Nanina schmeltziana Mouss., proposed a new sub-genus Trochonanina, without type selection, in which he included Helix mozambicensis Pfr., and that the prior designation of genotype appears to be that of Kobelt, who designated in 1879 (Ill. Conch.-buch, p. 217) H. mossambicensis Pfr. as type. If Kobelt's designation be accepted, Trochonanina, which is now universally applied to certain Asiatic and Polynesian species, would have to be accepted instead of Ledoulxia for the well-known African forms now placed in the last-named genus. But as explained in the case of Gonaxis and Odontartemon, it appears to me against common sense to accept this elementary work of Kobelt's, which

has been entirely ignored by nearly all the leading authorities since its publication, as well as by Kobelt himself in his later treatment of Odontartemon, as exercising the slightest influence on the fixation of types, which he merely intended to be certain species more or less exemplifying the typical form of such genera for which he cited one.

#### Ledoulxia mozambicensis (Pfr.).

Ref. List No. 151.

(Text-Fig. 17.)

1855. Helix mozambicensis Pfr., P.Z.S., p. 91, pl. xxxi, f. 9. D.F. 1870. Martensia mossambicensis Pfr., Semp., Reis. Archip. Philippin., ii, 3, p. 42, pl. iii, f. 5; pl. vi, f. 15. A.R.

1883. Trochomorpha mozambica Bgt., Ann. Sci. Nat. Paris, xv, p. 107. L.

1907. Martensia entebbana Pollon., Boll. Mus. Torino, xxii, 561, p. 1. D.

1909. Martensia entebbana Pollon., Il Ruwenzori, i, p. 194, pl. xx, f. 12–13. D.F.

1912. Martensia mozambicensis Pfr., G.-Aust., A.M.N.H., ix, p. 570. N.

1919. Ledoulxia mozambicensis Pfr. (=entebbana Pollon.), Pilsb., Bull. Amer. Mus., xl, p. 247, pl. x, f. 2-3. N.F.

1925. Ledoulxia mozambicensis Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 131, pl. viii, f. 1-4. N.A.R.

Shell of fair size, subglobosely conoid, perforate, thin, dull and asperate above, smooth and glossy beneath, subtransparent, corneous brown above, usually with faint zone of darker shade above the suture, olivaceous beneath. Spire exserted, sides very slightly convex, apex bluntly rounded. Whorls 6½, gradually increasing, convex, sharply carinate at periphery, extreme apex smooth, next 1½ whorl with close, fine, incised microspiral lines which cut across some vestigial transverse striolae; about this point the spirals disappear from the upper surface and the sculpture consists of close, fine, regular, curved, oblique transverse costulae, which become gradually stronger and more distant on each succeeding whorl, but only extend to the periphery, the base being practically smooth, with a few faint but coarse growth lines and close, regular spiral grooves; suture shallow, simple, or margined when the peripheral keel rises above the succeeding whorls. Aperture horizontal, 3-lunate, peristome simple, acute, labrum receding considerably in a gentle curve to the base, columella very short, margin scarcely reflexed, not obscuring the narrow umbilicus. A very typical example from the Lebombo Mts. measures

Diam. maj. 15.6, min. 14.5; alt. 9.8; apert. alt. 5.8, lat. 7.2 mm.

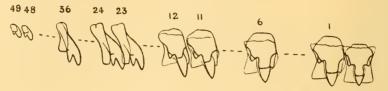
LORENZO MARQUES. Tette (type, Peters); Movene (Penther); Wanetsi R., Majude Dist. (Bell Marley); Antioko; Lebombo Mts. (Junod); Zangwe Basin; Mtisherra R.; Chimoio District (Cressy).

TRANSVAAL. Barberton (Fry); Zoutpansberg (Cregoe); Sabi Game Reserve (Gill).

S. RHODESIA. Salisbury (Miss Weineck); near Mtoko (Melle). Widely distributed in East Africa.

Type in British Museum.

The jaw is rather thin and practically smooth, with a large median projection; central and lateral teeth tricuspid, former slightly smaller



Text-fig. 17.—Ledoulxia mozambicensis (Pfr.), Lebombo Mountains.

Representative teeth from the radula; ×350.

than latter, of which the endocones are narrow and not very conspicuous; marginals with strongly curved bifid cusps, gradually decreasing in size towards the edges of the radula; formulæ of two examples  $(42+11+1+11+40) \times 148$  and  $(35+11+1+11+36) \times 135$ .

Semper's and Austen's figures of radulae ascribed to L. mozambicensis differ from mine and from each other, and all three may possibly represent those of different species.

#### Ledoulxia bloyeti (Bgt.).

1889. Trochonanina bloyeti Bgt., Moll. Afr. équat., p. 21, pl. ii, f. 10-12. D.F.

1897. Trochonanina (Martensia) bloyeti Bgt., Mts., D.O.A., iv, p. 48. N.

1904. Trochonanina bloyeti Bgt., Rchbr. & Germ., Mem. Soc. Zool. Fr., xvii, p. 18. N.

1918. Trochonanina (Martensia) bloyeti Bgt., Germ., Bull. Mus. Paris, xxiv, p. 258. N.

1925. Ledoulxia bloyeti Bgt., Conn., Trans. R. Soc. S. Africa, xii, p. 130. N.

The sculpture is of similar pattern to that of mozambicensis, but that of the protoconch coarser, the microspiral grooves appearing like regular lines of small distinct nodules; there are traces also of spiral lineation between, but not cutting, the transverse costae on the later whorls of fresh specimens. The shell is more depressed than mozambicensis, nearly equally convex above and below, with convex sides and wider umbilicus. Bourguignat stresses the fact that the costae are

furnished along the suture with white points, which are extremely obscure, even if present in Cressy's examples, but these agree in other respects so closely with the original figure and description that there can be no doubt as to the accuracy of their determination. The shell is remarkable for its flattened spire with convex sides, and easily recognisable. A specimen from Mtisherra Valley with 5½ whorls

measures

Diam. maj. 14.7, min. 13.3; alt. 7.5; apert. alt. 4.5, lat. 7.2 mm.

Hab. LORENZO MARQUES. Mtisherra R. Valley; Zangwe Basin (Cressy).

Type ubi?

Described from Kondoa, Tanganyika Territory, and also known from Zanzibar and the Oualamo District.

## Ledoulxia elatior (Mts.). Ref. List No. 151 (pars).

1866. Trochomorpha (?) mossambicensis Pfr., var. elatior Mts., Mal. Blätt., xiii, p. 92. D.

1925. Ledoulxia elatior Mts., Conn., Trans. R. Soc. S. Africa, xii, p. 136. N.F.

1927. Ledoulxia mozambicensis Pfr., var. elatior Mts., Conn., Proc. Mal. Soc., xvii, p. 170. N.

Thanks to the kindness of Dr. Thiele, of the Berlin Museum, I was enabled to publish seven figures more or less representing this form in 1925 and his subjoined report on them: "Under the name of H. mozambicensis, var. elatior, Martens designated several shells from different localities, which I have drawn by the side of yours from the Mtisherra River Valley. That from Bongo, Abyssinia, must be regarded as typical—all the shells figured are somewhat different from one another—the material is not extensive enough to decide whether they are varieties, or only local forms, of a single species, or in part, distinct species; the embryonal sculpture is not always recognisable, as in the case of that from Bongo."

It is clear from the foregoing that this species must remain doubtful until further specimens from Bongo in better preservation are available for comparison; meanwhile I append details regarding one of Cressy's examples, which is probably referable thereto and certainly specifically distinct from other described forms known to me.

Sculpture on upper surface very different from that of mozambicensis, the transverse wrinkles on protoconch far stronger than the spirals, which are very faint, and the costulae on the succeeding whorls extremely close and fine, little more distant on the last than on the preceding whorls; the spiral grooving on the base

is strong. Shell considerably more high-spired than mozambicensis with much finer transverse sculpture; whorls  $6\frac{1}{2}$ , not very convex, carinate at periphery, suture shallow; umbilicus narrower than in mozambicensis and more overhung by columellar margin.

Diam. maj. 15.6, min. 14.8; alt. 11.4; apert. alt. 6.3, lat. 7.9 mm.

Hab. LORENZO MARQUES. Itschongove (Schenck); Mtisherra R. Valley (Cressy).

Described from Abyssinia and apparently rather widely distributed in East Africa.

Type in Berlin Museum.

# Ledoulxia albopicta (Mts.).

Ref. List No. 151 (pars).

1869. Nanina mossambicensis Pfr., var. albopicta Mts., von der Decken's Reisen, iii, p. 56, pl. i, f. 2. D.F.

1885. Trochonanina anceyi Bgt., Helixarionidées, p. 9. D.

1887. subjenynsi Ancey, Le Nat., ix, p. 79. D.

1897. (Martensia) jenynsi Pfr., var. subjenynsi Ancey, Mts., D.O.A., iv, p. 49. D.

1897. Trochonanina mossambicensis Pfr., var. albopicta Mts., ibid., p. 47. D.

1925. Ledoulxia albopicta Mts., Conn., Trans. R. Soc. S. Africa, xii, p. 135. N.

1932. Ledoulxia albopicta Mts., Haas, Senckenbergiana, xiv, p. 179, pl., f. 1–2. D.F.

Shell small, depressed conoid, perforate, smooth, dull, semi-transparent, early whorls (4-5) glossy, corneous yellow-brown, remainder cream, mottled above and more sparsely beneath with streaks, spots, bands, or blotches of brown and usually with a very narrow peripheral brown band. Spire moderately exserted, sides straight, apex narrowly rounded. Whorls 5½, rather convex, protoconch engraved for about 2 whorls after the extreme apex with exceedingly fine, close, faint microspiral lines, remainder bearing extremely close, fine and regular transverse striae; basal spirals strong and rather closer than in some species; suture simple, well defined; columellar margin scarcely reflexed, not obscuring the narrow umbilicus.

Diam. maj. 12.0, min. 11.2; alt. 7.4; apert. alt. 4.8, lat. 5.8 mm.

#### Hab. LORENZO MARQUES. Tette (Peters).

A small, well-known species, remarkable for its brown and white mottling; described from "East Africa" and known from several localities in that region.

Type in Berlin Museum.

Genus Trochozonites Pfeffer, 1883 (Abh. Naturwiss. Verein. Hamburg, vii, 2, p. 23). Type Trochonanina percarinata Mts.

Shell small to medium, conoid, perforate, corneous brown, sides of spire convex, straight, or concave, apical sculpture microspirally striate (Trochozonites s.s.), practically smooth (section Zonitrochus Pilsb.) or with transverse ribs (section Teleozonites Pilsb.).

Created for two West African species, percarinatus (Mts.) and ibuensis (Pfr.), on purely conchological grounds, as Pfeffer acknowledged that the meagre details he could glean from the animals before him did not allow of any general account of their anatomy.

### Trochozonites dioryx (M. & P.). Ref. List No. 153.

1892. Helix (Trochozonites) dioryx M. & P., A.M.N.H., ix, p. 89, pl. v, f. 2. D.F.

Shell small, umbilicate, conical, much weathered, but normally thin, transparent, corneous brown. Spire exserted, sides almost straight, very slightly concave near the apex, meeting at an angle of just below 90°, apex submamillate. Whorls 6½, not very convex, sharply carinate at the periphery, with another carina, forming a prominent ridge closely encircling the suture on the post-apical whorls; protoconch, 2 whorls, strongly and closely microscopically spirally striate, remainder sculptured to the periphery with strong, somewhat distant, slightly oblique, jagged costae, about 3 to half a mm. on the later whorls, and becoming weak and regular on the base; suture forming a flat surface within the surrounding ridges, crossed at right angles by the costae; minor sculptural details invisible owing to weathering. Aperture obliquely 3-lunar, peristome simple, acute, labrum sharply angulate, scarcely receding in profile, columella short, margin very narrowly reflexed, half obscuring the very small umbilicus.

Diam. maj. (type) 7.3, min. 7.0; alt. 6.1; apert. alt. 3.0, lat. 3.1 mm.

Hab. LITTLE NAMAQUALAND. Dunes near the coast, Robbe Bay, Port Nolloth (Layard).

Type in British Museum.

Only the type is known; it is a true Trochozonites, similar to T. suturalis d'Ailly in the peculiar circumsutural carina, but with far more distant transverse costulation.

# Sub-Family Durgellinae.

Mantle with shell lobes, foot with lobelet over mucous pore, jaw as a rule without median projection, laterals fewer than usual or lacking, marginals usually very numerous, with dentate (seldom smooth) outer edge; dart sac usually present.

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Genus Sitala H. Ad. 1865 (P.Z.S., p. 408). Type Helix infula Bs. (=Conulema Stol., 1871).

Small conoid shells, usually with spiral sculpture on the upper surface, and rounded periphery; animal with caudal mucous gland and horn, sole grooved, mantle with 2 shell and 2 dorsal lobes, small and without appendages, penis with simple terminal appendix, receptaculum seminis club-shaped, thickened at end of stalk; dart sac, if present, long; radula with over 100 rows of very numerous (300–400) teeth, central tricuspid, 2 or 3 laterals with an outer cusp and numerous marginals with denticulate outer edge.

#### Sitala diaphana Conn.

1922. Sitala diaphana Conn., A.M.N.H., x, p. 116. D.
1925. ,, ,, Trans. R. Soc. S. Africa, xii, p. 137, pl. iv, f. 8. N.F.

Shell rather small, globose conic, imperforate, very thin, transparent, smooth, shining, pale corneous yellow or vitreous. Spire somewhat exserted, sides regular, apical angle about 80°, summit conical. Whorls in type 5, rapidly increasing, rounded with very slight peripheral angulation, covered on both sides and almost to the apex with very faint, irregular, straight transverse striolae, only visible under a lens, and close microspiral striolae; suture well defined. Aperture rounded lunate, columella short and straight, upper margin very narrowly, solidly reflexed. Diam. maj. 4·2, min. 3·8; alt. 4·0; apert. alt. 2·0, lat. 2·2 mm.

Hab. LORENZO MARQUES. District north of Macequece (type, Cressy).

NATAL. Karkloof (Taynton); Mgeni Krantz (Falcon).

Type in British Museum.

The Natal examples are larger than type, with 6 whorls, diam.  $5.3 \times 5.0$ , alt. 5.0 mm., but do not appear separable, while yet other shells which I cannot distinguish from the present species have been collected by Pitman in Kenya Colony.

Sitala jenynsi (Pfr.). Ref. List, page 282.

1845. *Helix jenynsi* Pfr., P.Z.S., p. 131. *D*.

1859. Nanina ,, , , , Mts., Mal. Blätt., vi, p. 211. L.

1897. Trochonanina jenynsi Pfr., Mts., D.O.A., iv, p. 48. N.

1925. Ledoulxia jenynsi Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 131. N.L.

1931. Sitala jenynsi Pfr., Thiele, Sitz.-Ber. Ges. Nat. Fr. Berlin, p. 395. N.R.

Shell comparatively large, subglobosely conoid, narrowly perforate, thin, smooth, rather dull, sub-transparent, normally chalky white above, with a narrow brown peripheral band. Spire moderately exserted, sides straight and regular, apex narrowly rounded. Whorls 6, convex, carinate at periphery, gradually increasing, protoconch sculptured after extreme apex with transverse puckers and hardly visible microspiral lines, remaining whorls bearing above and below extremely close, fine, and faint oblique striolae and strong, close, regular, spiral grooves; suture simple. Aperture horizontal, irregularly quadrate, peristome acute, labrum receding regularly in profile, columella very short, margin narrowly reflexed, overhanging but little the very narrow umbilicus. The shell described from Zangwe Basin measures

Diam. maj. 15·3, min. 13·6; alt. 9·2; apert. alt. 5·8, lat. 7·2 mm.

Hab. LORENZO MARQUES. Tette (Peters); Zangwe Basin; Chimoio District (Cressy).

Type in British Museum.

A well-known east coast species; Thiele (l.c., p. 395, pl., f. 3) has described a var. *alba* from Pangani and I have collected at Dar-es-Salaam a pretty form, chocolate above but for a narrow infrasutural white band, and with a chocolate band just below the periphery.

At first sight this species would be attributed to *Ledoulxia*, which has actually been the case until Thiele proved it otherwise.

# Sub-Family Kaliellinae.

Shell small, conical, last whorl rounded or angulate, foot often with small projection over caudal pore; lung cavity deep; genital orifice near right tentacle; dart gland lacking.

# Genus Kaliella Blanford, 1863 (A.M.N.H., xi, p. 83).

Type H. barrakporensis Pfr.

Shell small, conoid, usually with fine, close striolae above and no spirals except on base; animal much like that of Sitala, with caudal gland and lobe, but no dart sac; a pear-shaped lime gland at junction of vas deferens and epiphallus, no caecum. Radula with far fewer teeth (about 67) in each row than Sitala, central and laterals tricuspid, marginals pectinate.

A. Carinate at periphery.

Kaliella barrakporensis (Pfr.).

Ref. List No. 188 (as sigurensis).

1852. Helix barrakporensis Pfr., P.Z.S., p. 156. D.

1882. Kaliella sigurensis G.-Aust., L. & F. W. Moll. India, i, p. 5, pl. i, f. 11. D.F.

1890. Helix (Trochonanina) pretoriensis M. & P., A.M.N.H., vi, p. 469. D.

1914. Kaliella barrakporensis Pfr. (=sigurensis G.-Aust.), Dautz. & Germ., Rev. Zool. Afr., iv, p. 17.

1916. Kaliella sigurensis G.-Aust., Conn., Ann. S.A. Mus., xiii, p. 183. N.

1923. Kaliella barrakporensis Pfr. (=victoriae Prest.), Germ., Voy. Babault, p. 39, pl. ii, f. 60–61. N.F.

1925. Kaliella barrakporensis Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 137. N.

Shell small, conical, minutely umbilicate, fairly smooth and glossy. Spire conical, sides very slightly convex, apex narrowly rounded. Whorls 6, moderately convex, slowly increasing, carinate at periphery, slightly convex beneath, all but extreme apex sculptured with very fine, close, regular, straight, oblique transverse striolae, less regular on base, which is engraved with extremely fine and close microspiral lines; suture well defined. Aperture horizontally lunate or semicircular, labrum straight and receding little in profile, columella short, erect, concave, margin narrowly reflexed, half covering the minute umbilicus. A Pretoria specimen measures

Alt. 3·3, lat. 3·1; apert. alt. 0·75, lat. 1·6, last whorl 2·2 mm.

Hab. TRANSVAAL. Pretoria District (pretoriensis, Farquhar).

NATAL. Pietermaritzburg; Dargle; Tyeloti; Equeefa; Karkloof; Edendale Falls (Burnup); Southport (Puzey); Winkle Spruit (Akerman).

ZULULAND. Eshowe (Burnup); Mfongosi (Jones).

LORENZO MARQUES. District north of Macequece (Cressy).

A common Indian species, which appears to be widely distributed over the tropical and south-eastern parts of Africa.

#### Kaliella victoriae Prest. Ref. List No. 189.

1912. Kaliella victoriae Prest., A.M.N.H., ix, p. 69, f. 2; p. 70. F.D. Germain (v. supra, 1923) considers this species a synonym of the foregoing, with slightly more accentuated sculpture. I incline to the same opinion, but the microspiral lines on the base are so much more pronounced, slightly coarser and more distant, that it may be advis-

able to await further investigation by expert anatomists prior to forming a definite conclusion. My largest paratype measures: Alt. 4·7, lat. 4·1; last whorl 2·4 mm.

Hab. S. RHODESIA. Victoria Falls (Connolly). Type in Tervueren Museum.

B. Rounded at periphery.
Kaliella euconuloides M. & P.
Ref. List No. 187.

1908. Kaliella euconuloides M. & P., A.M.N.H., i, p. 133, pl. vii, f. 5. D.F.

Shell small, minutely umbilicate, conoid; spire subgradate, barely convex, apex rounded. Whorls 6, very convex, rounded at periphery, sculptured almost to extreme apex with exceedingly fine and close, faint, regular, straight, vertical striolae, and on base with equally fine and close microspiral lines; suture deep; apertural features as in genus.

Alt. 2.5, lat. 2.7; last whorl 1.8 mm.

Hab. NATAL. Dargle (type); Karkloof; Inhluzani; Game Pass; Van Reenen (Burnup); Mkolombe Mts. (Thomasset).

Type lost; protype in British Museum.

Kaliella connollyi (Prest.). Ref. List No. 154.

1912. Thapsiella connollyi Prest., A.M.N.H., ix, p. 70, f. 3. D.F.

Differs from the foregoing in turbinate form, wider umbilicus, and more rapidly increasing breadth of whorl, of which there are 5, very convex, sculptured above with close, regular, slightly curved and oblique striae, becoming weaker on the base, which shows the usual close, fine, and faint microspiral lineation; suture impressed, other features as in euconuloides.

Alt. 2.2, lat. 2.9; last whorl 1.7 mm.

Hab. S. RHODESIA. Victoria Falls (Connolly).

Type in Tervueren Museum.

It is somewhat uncertain whether the last two species are true *Kaliellae*, but their sculpture and general features, except for absence of keel, accord with that genus.

#### FAMILY UROCYCLIDAE.

Oxygnathous slugs furnished with a caudal gland and an epiphallus bearing flagella; foot tripartite, mantle forming an oval anterior shield, usually with a pore over the small contained shell, which is oval, patelliform, and non-spiral.

Genus *Urocyclus* Gray, 1864 (P.Z.S., p. 250). Type *U. kirkii* Gray.

Body elongate, attached its whole length to upper surface of foot, mantle scutiform, granular, with a small pit in middle of hind margin; subcaudal gland very large and deep, on upper surface of tip of tail, respiratory orifice on middle of right side of mantle, genital opening at base of right tentacle, tentacles 4, retractile, lower small. Epiphallus with a caecum and a minute flagellum; dart-gland present, with a retractor.

# Urocyclus kirkii Gray.

Ref. List No. 109.

1864. Urocyclus kirkii Gray, P.Z.S., p. 251. D.F.

1918. ,, *kirki* ,, Germ., Bull. Mus. Paris, p. 361. *D*. 1925. ,, ,, ,, Conn., Trans. R. Soc. S. Africa, xii, p. 138. *L*.

"Pale brown with minute square black spots on sides and a black streak on each side of back, middle of back with two darker brown streaks; sides of body with divergent sunken lines; margin of foot with a series of small black stripes" (Gray).

The type is now buff, no black spots on sides, a dark brown line along each side of back and mantle and only faint trace of any down middle of back; foot tripartite, side areas wider than central. Animal in alcohol measures

Long. 55, lat. 9, mantle 17 mm.

Binney states that the jaw is very low, slightly arcuate, without ribs or median projection; central tooth tricuspid, laterals bicuspid, lacking endocone, marginals aculeate with very small obtuse ectocone.

Hab. NATAL. Durban (fide Sturany).

LORENZO MARQUES. Andrada (Vasse); Inhambane; Delagoa Bay (fide Sturany).

Type in British Museum.

Described from near the mouth of R. Zambesi (Kirk).

 $Urocyclus\ flavescens\ ({\rm Kfstn.}).$ 

(Pl. xvi, f. 11–12.)

Ref. List No. 198.

1866. Parmarion flavescens Kfstn., Mal. Blätt., xiii, p. 70, pl. ii, f. 1–8. D.F.A.R.

1918. Urocyclus flavescens Kfstn., Germ., Bull. Mus. Paris, p. 358. D. 1925. ,, ,, ,, Conn., Trans. R. Soc. S. Africa, xii, p. 138. N.

"Animal 35 mm. long, uniform dingy grey-brown, with general resemblance to Arion. Mantle large, oval, about one third of total length, its front third free and on the right side at this point are the respiratory orifice and anus. Close to its hind end the mantle is perforated by a small but clear hole, within which is exposed a portion of the small, corneous, flat shell, on which no spire is perceptible. The back is somewhat swollen to about its last quarter, and contains the large visceral mass, from which point it narrows and descends, containing only the hind portion of the liver; mucous pore a short slit on end of back; foot as long as, and clearly detached from body, sole sharply delineated, about a quarter the breadth of foot; jaw strong, with central projection, radula similar to that of Limax" (Keferstein).

The anatomy is fully treated by Keferstein: Germain states that the animal in alcohol is: long. 34, lat. max. 6, alt. 83 mm.

Hab. LORENZO MARQUES. Inhambane; Mungurumbe (Peters); Mt. Vumba, 4300 feet (Vasse); Delagoa Bay (Spencer).

NATAL. Pinetown; Pietermaritzburg (Burnup).

Described from Quilimane; type in Berlin Museum.

The record of this species by Gibbons, 1879, should be expunged from my Reference List, as it has since been proved to relate to Kirkia gibbonsi Pollonera, from Mozambique.

### Urocyclus fasciatus (Mts.). Ref. List No. 197.

1879. Aspidoporus fasciatus Mts., Monatsb. Akad. Wiss. Berlin, p. 736. D.

1918. Urocyclus fasciatus Mts., Germ., Bull. Mus. Paris, p. 360. D. 1925. " Conn., Trans. R. Soc. S. Africa, xii, p. 138. L.

"Paler and slimmer than flavescens, in spirit 32 mm. long and 5½ broad, isabella vellow with on both sides of body a white band, which begins below the middle of mantle, runs to the caudal pore and projects to the rear somewhat like a keel; no dorsal keel; rugation weaker than in flavescens" (Martens).

Germain states that the shell is oval, attenuate behind, very finely concentrically striate, nucleus submedian.

Hab. LORENZO MARQUES. Andrada (Vasse).

NATAL. Pietermaritzburg (Burnup).

Described from Quilimane; type in Berlin Museum.

### Urocyclus pallescens Ckll. Ref. List No. 201.

1891. Urocyclus pallescens Ckll., A.M.N.H., vii, p. 101. D.

The original description states that the colour is pale greyish ochre without spots, reticulation on body in longitudinal squarish series, about 12 on each side keel indistinct, no lateral ridges, mucous pore smaller than in kirkii, mantle reticulated, bluntly angulate behind, 12 mm. long, opening only a narrow slit, or small, rather oblong hole, very much smaller than in kirkii and very near the hind end; respiratory orifice as in Heynemann's figure of fasciatus. Central area of foot about as wide as either lateral area, shell strong, well formed,

Long. 6, lat. 4 mm., animal in alcohol  $31\frac{1}{2}$  mm.

Hab. NATAL. Durban (type, Craven, 1875).

ZULULAND. Nagana Reserve (H. H. Curzon).

Type presumably in British Museum.

"Most nearly allied to *U. flavescens* Kfstn., of which it may prove a sub-species; Keferstein's figure shows a slug differing from ours in the shape of the body, and especially of the mantle, and the opening of the mantle is different. *U. kraussianus* differs from *pallescens* in its colour and in shape of the mantle" (Cockerell).

The slug from Nagana Reserve agrees pretty well with the foregoing description; the mantle and side areas of foot are buff, central area and body greyish ochre; granulation on body coarser than in *flavescens*, mantle opening minute, and caudal pore small.

### Urocyclus (?) kraussianus (Heynem.). Ref. List No. 200.

1848. Limax (Arion) (?) sp., Krs., Südafr. Moll., p. 73. D.

1862. ,, kraussianus Heynem., Mal. Blätt., ix, p. 217. D.

1863. ,, ,, ,, ,, x, p. 211, pl. iii, f. 2. N.R.

1885. *Urocyclus* (?) *kraussianus* Heynem., Jahrb. D. Mal. Ges., xii, p. 293. N.

1891. Urocyclus kraussianus Heynem., Ckll., A.M.N.H., vii, p. 102. N.

1910. Urocyclus kraussianus Heynem., Cllge., Ann. Natal Mus., ii, p. 163. N.

The original description of this very dubious species, as amended by Heynemann in 1862, should apparently read: Less slender and delicate than foregoing ( $Milax\ capensis$ ), greyish black, rugate,  $1\frac{1}{2}$  inch long. Mantle oval, thick, rugose, rounded fore and aft; respiratory opening somewhat in front of middle of mantle. Shell thin, convex, broad, very membranaceous on margins with easily visible lines of growth; jaw with sharp, narrow, not very prominent median projection; teeth of radula similar to agrestis, central tricuspid, laterals with ectocone, marginals beginning at 24th tooth somewhat aculeate, still with ectocone; at 33rd tooth aculeation is complete and the ectocone gives place to a small exterior protuberance; extremities of radula deficient.

After further discussion in 1863 Heynemann concluded that this Kraussian slug was a *Limax*, but in 1885 he wrote that, since the discovery of African limaciform pulmonates with open and closed mantle

opening and caudal pore, he had formed the opinion that he was much mistaken in placing this species, of which he had several specimens under notice when he first examined it, in Limax, and this had been confirmed on further investigation; time had rendered them practically unrecognisable, but he had now found the caudal pore, and on that account the species appeared in his African list under another generic name, Urocyclus (?) kraussianus Heynemann, Hab. Natal.

Hab. CAPE PENINSULA. Cape Town (Krauss).

NATAL (fide Heynemann).

Type formerly in Stuttgart Museum, but from Heynemann's later statement apparently desiccated or decomposed.

#### FAMILY ZONITIDAE.

Shell usually depressed globose and thin, with a simple peristome; jaw smooth with median projection, central tooth nearly always tricuspid, laterals mostly few in number, with ectocone and often an endocone; marginals aculeate. Foot usually with lateral grooves and a small caudal pore; mantle without shell-lobes.

#### Sub-Family Zonitinae.

Foot sole tripartite or sometimes undivided; receptacular duct not forked; vagina often with glands, penis without papilla, no dart.

> Genus Oxychilus Fitz., 1833 (Beitr. Landesk. Oesterr., iii, p. 100). Type Helix cellaria Müll.

(=Polita Held, 1837; Lucilla Lowe, 1855; Euhyalina Albers, 1857 and Euhyalinia Taylor, 1907).

Shell thin, corneous, depressed, glossy, umbilicate, brown above, often slightly lacteous beneath, peristome simple; animal with tripartite sole, well-marked pedal grooves and a small caudal mucous pore; genital opening on side of neck; right eye-muscle crossing penis, which, with epiphallus, is well developed; vagina with gland. Radula with comparatively few teeth in each row, central small, tricuspid, 2-5 tricuspid laterals, marginals aculeate, large.

All the species now inhabiting South Africa have been introduced and do not appear as yet to be distributed far outside the limits of urban cultivation.

The gender of Fitzinger's Latinised name is open to question, and

while here treating it as masculine, I do so without prejudice to the views of those writers who regard it as neuter.

Oxychilus draparnaldi (Beck). Ref. List No. 183 (as draparnaudi).

1801. Helix lucida Drap., Tabl. Moll. Fr., p. 96. D.

1805. ,<br/>, nitida Drap., Hist. Moll. Fr., p. 117, pl. viii, f. 23–25. D.F.

1837. Helix draparnaldi (=nitida Drap.), Beck, Index Moll., p. 6.

1914. Hyalinia lucida Drap., Tayl., Mon., iii, p. 456. N.L.F.

1916. Polita draparnaudi Beck, Conn., Ann. S.A. Mus., xiii, p. 183. N.

Shell comparatively large, subdiscoid, umbilicate, thin, smooth, glossy, bright corneous brown above, paler beneath. Spire little raised; whorls 6, nearly flat, rounded at periphery at all stages of growth, regularly increasing, sculptured with extremely faint, somewhat irregular, slightly curved and oblique growth striolae; suture simple, well defined. Aperture \(^3\_4\)-oval, slightly oblique, labrum slightly curved and receding gradually to base, columella very short, margin shortly reflexed but not overhanging the umbilicus, which is nearly funicular but just exposes all the whorls. A well-grown Kenilworth example measures

Diam. maj. 15·0, min. 13·3; alt. 8·0; apert. alt. 6·3, lat. 6·9 mm.

Hab. CAPE PENINSULA. Rondebosch (Oakley); Kenilworth (Connolly).

GRIQUALAND WEST. Kimberley (O. Williams).

Specimens from Kenilworth prove on anatomical grounds that they are correctly determined; Taylor states that in the majority of English examples the radula shows 3 tricuspid laterals and then a transitional tooth lacking the outer cusp, followed by 10 aculeate marginals. Although to a great extent vegetarian, this, like other members of the genus, is also carnivorous, even devouring its cousins O. cellarius and Z. arboreus, but is no match for Nata, which I have seen devour it in turn.

Originals in Vienna Museum.

I entered fully into the proper name for this species in my Reference List and find that my arguments are now fairly generally accepted.

#### Oxychilus cellarius (Müll.). Ref. List No. 182.

1774. Helix cellaria Müll., Verm., ii, p. 28. D.

1914. Hyalinia cellaria Müll., Tayl., Mon., iii, p. 457. N.F.

1916. Polita cellaria Müll., Conn., Ann. S.A. Mus., xiii, p. 182. N.

(Other recent references of no local interest omitted.)

Smaller and of comparatively less altitude than the foregoing, owing to the aperture being more lateral and less oblique, while the whorls increase a trifle more slowly. My largest Cape Town example, with 5½ whorls, measures

Diam. maj. 9.9, min. 9.0; alt. 4.8; apert. alt. 3.7, lat. 4.0 mm., while draparnaldi of approximately the same size has diam. maj. 10.0, min. 8.8, alt. 5.1 mm.

The radula figured by Taylor has 35 rows of teeth, with tricuspid central and 2 large tricuspid laterals on each side, then a transitional tooth lacking the outer cusp, and 11 aculeate marginals.

Hab. CAPE PENINSULA. Rondebosch (Benson, 1846); widely distributed.

CAPE PROVINCE. Stellenbosch (Péringuey); Somerset East (Miss Bowker); Somerset West (Purcell).

GRIQUALAND WEST. Kimberley (Gowie); Newlands (Miss v. Slavern).

S. RHODESIA. Bulawayo (in South African Museum).

Probable type in Copenhagen Museum.

Specimens from St. James, C.P., have been determined on anatomical grounds as belonging to this common European species.

#### Oxychilus alliarius (Miller). Ref. List No. 181.

1822. Helix alliaria Mill., Ann. Philos., iii, p. 379. D.

1914. Hyalinia alliaria Mill., Tayl., Mon., iii, p. 465. N.

1916. Polita alliaria Mill., Conn., Ann. S.A. Mus., xiii, p. 182. N.

Differs from cellarius in smaller size, darker colour, less depressed spire, thicker shell, and frequently far stronger sculpture. The Cape Town race is nearly smooth, but in that from Grahamstown the first  $1\frac{3}{4}$  whorls are smooth and the remainder covered with strong, fairly close and regular, slightly curved, transverse growth striae, extending into the funicular umbilicus. My largest Grahamstown example, with 41 whorls, measures

Diam. maj. 6·3, min. 5·5; alt. 3·3; apert. alt. 2·6, lat. 2·8 mm.

Hab. CAPE PENINSULA. Cape Town (Connolly). CAPE PROVINCE. Grahamstown (Farguhar).

A well-known European species, of which, however, the type appears to be lost; the animal is capable of exhaling a strong odour of garlic when annoyed, which readily provides for its identification when in live condition; the radula consists of about 35 rows of teeth, central small, tricuspid, 2 three-cusped laterals on either side, a transitional tooth lacking the outer cusp, and 9 aculeate marginals.

Genus Vitrea Fitz., 1833
(Beitr. Landesk. Oesterr., iii, p. 99)
(=Hyalinia Charp., 1837, and Crystallus Lowe, 1855).
Type Helix crystallina Müll.

Shell vitreous, smooth and glossy; central and lateral teeth tricuspid, marginals aculeate; genital opening near right tentacle, receptaculum seminis rudimentary, spermiduct thin, right eyemuscle between penis and vagina, penial retractor arising from columellar muscle.

### Vitrea crystallina (Müll.). Ref. List No. 180.

1774. Helix crystallina Müll., Verm., ii, p. 23. D. 1914. Hyalinia (Vitrea) crystallina Müll., Tayl., Mon., iii, p. 469. L.

(Synonymy and other recent references omitted.)

Shell very small, umbilicate, smooth and glossy, vitreous. Spire little raised. Whorls  $4\frac{1}{2}$ -5, convex, slowly increasing, first  $2\frac{1}{2}$  smooth, later bearing very fine and close transverse growth striolae; suture rather deep. Aperture  $\frac{3}{4}$ -lunar, labrum receding in a slight curve, columella weak and simple, umbilicus narrow; a Wynberg example measures

Diam. maj. 2.9, min. 2.7; alt. 1.5 mm.

Hab. CAPE PENINSULA. Cape Town and suburbs (plentiful). Type ubi?

A common and well-known European species.

### Sub-Family Gastrodontinae.

Stalk of receptaculum seminis forked at base, often with stylet in penis or in a sac; radula with tricuspid central and bicuspid laterals.

Genus Zonitoides Lehm., 1862 (Mal. Blätt., ix, p. 111). Type Helix nitida Müll.

Shell rather small, umbilicate, depressed globose; penis containing a large papilla with a calcareous plate, dart long and slender, developed in special dart sac which has a retractor that arises from spermathecal fork; sole undivided, genital opening rather remote from base of right tentacle, near front of visceral stalk.

#### Zonitoides arboreus (Say).

#### Ref. List No. 185.

1817. Helix arborea Say, Nicholson's Encyclopaedia, iv, pl. iv, f. 4. D.F.

1916. Zonitoides arboreus Say, Conn., Ann. S.A. Mus., xiii, p. 183. N.

1926. Zonitoides arboreus Say, Bartsch and Quick, J. Agric. Research, xxxii, p. 783, pll. i-iv. D.F.A.R.

1928. Zonitoides arboreus Say, Baker, Proc. Acad. Nat. Sci. Phila., lxxx, p. 39, pl. viii, f. 6-9. A.R.

1929. Zonitoides (Zonitellus) arboreus Say, Baker, Proc. Acad. Nat. Sci. Phila., lxxxi, p. 255, pl. viii, f. 7. A.

Shell small, much depressed globose, umbilicate, smooth and glossy, corneous brown. Spire not much raised; whorls 5, convex, gradually increasing, first  $1\frac{1}{2}$  smooth, remainder sculptured all over with close, fairly regular, slightly curved and oblique transverse striae and exceedingly fine, close and faint microspiral lineation; suture well defined. Aperture crescentic, labrum receding slightly in a gentle curve, columella weak, simple, umbilicus funiculate, rather narrow. A Kenilworth example measures

Diam. maj. 5·1, min. 4·7; alt. 2·3; apert. alt. 1·7, lat. 2·2 mm.

Hab. CAPE PROVINCE. Port Elizabeth (Layard); Grahamstown (Reeve); King Williamstown (Godfrey); East London (Kincaid); Fairford, Cathcart (Miss Cottrell); Queenstown (Becker); Port Alfred (Gowie).

GRIQUALAND WEST. Kimberley (S. van Lyssen).

CAPE PENINSULA. Kenilworth (Connolly).

TRANSVAAL. Pretoria (Connolly).

NATAL. Pietermaritzburg (Ponsonby); Dundee (Miss Hickey); Verulam (Cawston).

A common American species, introduced into many parts of the world, and not yet recorded in South Africa from other than cultivated localities; Bartsch and Quick state that is responsible for much of the cane disease produced by the pitting and mutilation of sugar cane roots in Louisiana. Radula formula  $(19+6+1+6+19)\times 77$ , central tricuspid, larger than first lateral, laterals with outer cusp, marginals aculeate, decreasing in size towards the margin.

#### Zonitoides africanus O. Bttg. Ref. List No. 184.

1910. Zonitoides africanus Bttg., Abh. Senckenb. Ges., xxxii, p. 436, pl. xxviii, f. 2. D.F.

1930. Zonitoides africanus Bttg., Conn., Ann. S.A. Mus., xxix, p. 279. N.

Only known in subfossil condition; slightly less convex above than the foregoing, and more so beneath, with slightly narrower, more funicular umbilicus. One of Rogers' shells has  $4\frac{1}{2}$  moderately convex whorls, with transverse sculpture as in *arboreus*, and measures

Diam. maj. 5.0, min. 4.5; alt. 2.7 mm.

Hab. DAMARALAND. Gobabis (type, subfossil, Hermann). BECHUANALAND. Tlapings Laagte Well, west of Vryburg (subfossil, Rogers).

Type in Senckenberg Museum.

The resemblance of the much-weathered examples of this species so far known to arboreus is sufficiently strong to justify its assignment to Zonitoides, but if such is its true position an interesting problem arises, as the only member of that genus now living in South Africa is the imported arboreus, Z. cupido M. & P. having proved to be a Gudeëlla. Boettger's fossil, however, appears absolutely identical with one from the Kharga Oasis, near Cairo, which has been identified, I think correctly, with nitidus Müll. If, therefore, africanus is actually conspecific with Müller's species, a point on which Dr. Haas is inclined to agree, and is accompanied both in the Tlapings Laagte and Kharga deposits by Vertigo antivertigo, another palaearctic species quite unknown in recent condition in the Ethiopian fauna, a hitherto uncontemplated problem is presented for geological consideration.

#### FAMILY LIMACIDAE.

Slugs with tripartite sole, peripodial grooves, but no caudal mucous pore; back usually keeled posteriorly, mantle anterior, with respiratory orifice behind the middle of its right margin, genital opening behind right ommatophore; shell degenerate, white, enclosed in mantle, flattened oval or oblong, with nucleus nearer posterior margin; jaw smooth, with central projection, radula with aculeate marginal teeth as in other Oxygnathous families.

It is practically certain that none of this palaearctic family is endemic to South Africa, for although two species of *Milax* have been described from the sub-continent, it is probable that they are merely forms of *gagates*, or possibly of some nearly related species introduced from the Atlantic Islands.

#### Sub-Family LIMACINAE.

Mantle concentrically wrinkled; keel usually restricted to posterior end of back; shell with nucleus usually on the left; endocone of lateral teeth more or less united with mesocone; genital organs with no well-developed epiphallus or spermatophore.

Genus Limax Lin., 1758

(Syst. Nat. Ed. x, 1, pp. 644, 652).

Type L. maximus Lin.

Right ocular retractor crossing penis; intestine with two forwardly directed loops; left division of liver posterior.

Three species of *Limax* have found their way to South Africa, but they are very distinct from one another and are now often placed in separate sections of the genus.

Limax maximus Lin.

(Pl. xiv, f. 1.)

Ref. List No. 191.

1758.  $Limax\ maximus\ Lin.$ , Syst. Nat. Ed. x, 1, p. 652. D.

1902. ,, ,, ,, Taylor, Mon. Brit. Moll., ii, p. 34, pl. vi (1903), f. 1–15. D.F.A.R.

1916. *Limax maximus* Lin., Conn., Ann. S.A. Mus., xiii, p. 184. *N*. 1926. ,, ,, Ellis, British Snails, p. 258, pl. xiii, f. 22–23; pl. xiv, f. 1. *D.F*.

Body slender, 100–160 mm. in length, tapering and keeled posteriorly, with about 48 longitudinal rows of elongate tubercles; colour usually yellowish grey or cinereous, banded or spotted with black in two or three lines along each side of the body, neck and foot-fringe pale, former with 2 dorsal grooves, enclosing a single row of tubercles and terminating in front as the facial grooves; mantle oblong, rounded in front, angulate behind, capable of being lifted up in front, usually marbled or spotted with black; sole whitish; shell situate under hinder part of mantle, oblong oval, 13  $\times$  7 mm. Jaw corneous brown, about 4  $\times$  1 mm., arcuate with strong, bluntly pointed central projection; radula 10  $\times$  5 mm., central and lateral teeth with sub-obsolete side cusps, marginals narrow, the outer 30–40 with the cusp weakly bifurcate, formula given by Taylor (62+20+1+20+62)  $\times$  168. Rectum without caecal diverticulum; prostate gland diverging from oviduct anteriorly; penis long; receptacular duct opening into atrium.

Hab. CAPE PENINSULA. Table Mountain; Newlande (Purcell; Lightfoot; Barnard).

All Cape Town animals I have seen, including the set on which

Collinge based his somewhat hesitating attribution of this species to that district, have a pale salmon-coloured body, ornamented with black spots, which are irregularly disposed on the mantle, but are arranged in longitudinal bands on the rest of the body, where they may frequently coalesce into rather broad, solid lines.

L. maximus is distributed throughout most of Europe to Asia Minor and Algeria, and is recorded from America, Australasia, and the North Atlantic Islands, its distribution south of the Equator being doubtless due to commerce.

#### Limax flavus Lin.

#### Ref. List No. 190.

1758. Limax flavus Lin., Syst. Nat. Ed. x, 1, p. 652. D. 1900. ,, ,, ,, Cllge., Ann. S.A. Mus., ii, p. 2. L. 1903. ,, ,, ,, Taylor, Mon. Brit. Moll., ii, p. 78, pl. x (1905), f. 3–9. D.F.A.R.

1926. Limax flavus Lin., Ellis, British Snails, p. 262, pl. xiii, f. 18–19; pl. xiv, f. 3. D.F.

Body 75–100 mm. in length, rounded above, somewhat keeled in rear, usually dusky amber, overspread with bluish grey, through which a large number of oblong rugae and the keel show in their original amber hue; foot-sole yellowish white; mantle narrow and rounded in front, broader and obtusely angulate in rear, with many irregular yellow spots; no dark lateral bands; shell subquadrate oval, apex a little distant from posterior margin and slightly to the left,  $9\times 6$  mm. Radula with unicuspid central and lateral teeth, marginals aculeate, some outer ones with small ectocone. Formula, given by Taylor,  $(45+20+1+20+45)\times 153$ . Rectum with long caecal diverticulum; prostate diverging from oviduct anteriorly; receptacular duct opening into vagina.

Hab. CAPE PENINSULA. Cape Town (Lightfoot); Table Mountain (Barnard).

NATAL. Pietermaritzburg (Burnup).

O.F.S. Smithfield (Kannemayer).

A species with many synonyms, recorded from temperate Europe, Asia Minor, Algeria, North Atlantic Islands, North and South America, Seychelles, Australasia, and Japan.

# Limax nyctelius Bgt.

1861. Limax nyctelius Bgt., Rev. et Mag. Zool., xiii, p. 305. D.

", ", ", ", Spic. Malac., p. 41, pl. ii, f. 3–4. D.F.
1864. ", ", Mal. Algérie, i, p. 38, pl. i, f. 1–2. D.F.

1891. Malacolimax nyctelius Bgt., Pollon, Boll. Mus. Torino, vi, No. 100, p. 2. N.

1921. Malacolimax nyctelius Bgt., Plry., J. de C., lxvi, p. 98. L.

Body 40-50 mm. long, tapering towards the hind end, where there is a very short, inconspicuous keel; mantle rounded in front and very obtusely angulate behind; ground colour of back usually light or medium brown in adult specimens, but yellow or pallid when young; mantle with a dark brown band on each side and sometimes a third median band on its hinder half; beyond the mantle the lateral bands continue to the hinder end as a pair of dark lines along the upper part of the back, and occasionally there are also dark spots below them, but the bands are often faint in adult specimens, though very conspicuous in the young; foot-fringe and sole pale. Shell oval-oblong, pointed behind,  $6 \times 4$  mm. Jaw about 2 mm. in length, with a broad central projection and fine cross striae; radula with tricuspid central and lateral teeth, though the endocones and ectocones are small, and aculeate marginals, the inner with single cusps in adults, but the outer teeth with ectocones which are often split into two. Formula of a Pietermaritzburg specimen  $(40+15+1+15+40)\times 130$ . Rectum with a long caecal diverticulum; prostate not diverging from oviduct; penis contorted; receptacular duct opening into atrium.

Hab. CAPE PENINSULA. Newlands (Warren).

CAPE PROVINCE. Michell's Pass, Ceres (Barnard); Grahamstown (?) (Dr Dru Drury).

NATAL. Pietermaritzburg (Warren).

This slug is a native of Algeria and Morocco, whence it appears to have been transported to South Africa and elsewhere, possibly with palms or dates. The presence of dark bands on the mantle, combined with the absence of a caudal mucous pore, makes it easy to distinguish from other species of slugs known to occur in South Africa.

I am deeply indebted for the foregoing particulars to H. Watson, who has based his description on South African examples attributable to Bourguignat's species. The original diagnosis of that author, copied in his later papers, treats of a small slug, 20–25 mm. long when extended, with the respiratory orifice very anterior, "which is very rare in Limax," but Pollonera has pointed out that this referred to an immature and probably somewhat abnormal specimen, since in many which he had examined the slug attained the length of A. agrestis and the respiratory orifice was not very anterior, but "latero posteriore," as in other species of the genus. Pallary has identified certain European animals, identical with the South African, with this hitherto little-known species. The single example from Grahamstown is rather darker than usual and slightly divergent internally from normal, but is probably referable to nyctelius.

Genus Agriolimax Mörch, 1865 (J. de C., xiii, p. 378). Type L. agrestis Lin.

Right ocular retractor free from penis; intestine with one forwardly directed loop; right division of liver posterior.

It is pretty generally accepted that Mörch's appropriate name will have to give place to one of several older that have been proposed for this genus, the oldest claimant being *Deroceras* Rafinesque, 1820, but there is so much disagreement at present as to whether Rafinesque's monotype, *Limax gracilis* Raf., is a recognisable species or otherwise, that it may be unwise as yet to discard *Agriolimax*, which is at least based on a solid foundation, in favour of a fresh name which may, in its turn, be liable to ultimate rejection.

Agriolimax reticulatus (Müll.). Ref. List No. 195 (as agrestis).

1774. Limax reticulatus Müll., Verm., ii, p. 10. D.

1904. Agriolimax agrestis Lin., varr. reticulata Müll., etc., Tayl., Mon. Brit. Moll., ii, p. 115, pl. xv (1906), f. 3 etc. D.F.

1915. Agriolimax reticulatus Müll., Luther, Acta Soc. Flor. Faun. Fenn., xl, 2, p. 5. D.A. Ecology.

1933.  $Deroceras \ reticulatum$  Müll., Ehrmann, Tierwelt Mitteleuropas, ii, p. 117. D.F.A.

Animal 30–60 mm. long, varying in colour from yellowish white to grey or brown, usually with irregular dark brown spots, which are often confluent in the dermal grooves so as to form a reticulate pattern. Internally the hermaphrodite gland is situate dorsally near the hinder end, and the penis bears a branched and lobed posterior gland.

While no instance of the true A. agrestis occurring in South Africa is known to Watson, he has verified some of the records as referring to the present species; I therefore repeat those given in my Reference List as possibly all attributable to reticulatus, with the proviso that such may not prove entirely accurate when similar slugs are collected again in some of the same localities.

Hab. CAPE PENINSULA. Cape Town (Lightfoot); Cape Flats (Schultze); Green Point (Roebuck); Millers Point (German South Polar Expedition).

CAPE PROVINCE. Caledon; East London (Mrs. Longstaff); Stellenbosch; Ceres (Lightfoot).

NATAL. Pietermaritzburg (Burnup); Albert Falls (Akerman).

Luther treats very fully of the difference between *L. agrestis* and *reticulatus*, which had been almost universally regarded as a mere variety of the former species. The figure of *L. agrestis* was inserted on pl. XIV before these notes were written, but the two species are extremely near akin.

### Agriolimax laevis (Müll.).

Ref. List No. 196.

1774. Limax laevis Müll., Verm., ii, p. 1. D.

1904. Agriolimax laevis Müll., Tayl., Mon. Brit. Moll., ii, p. 121, pl. xv (1906), f. 5-8. D.F.A.R.

1916. Agriolimax laevis Müll., Conn., Ann. S.A. Mus., xiii, p. 185. N.L.

Body relatively smooth and glossy, usually reddish brown or chocolate, rounded except for short keel on tail, mantle large, rounded fore and aft, somewhat paler than body, concentrically ridged, neck very long, tentacles black and thick, with large black bulbs, foot tripartite, usually light brown; length of animal about 15–20 mm. Shell oblong oval, white and glossy, with an indistinct oblique ridge from apex to front of right side, apex towards left posterior angle, concentric striae arcuate, numerous and distinct,

Long. 3.0, lat. 1.5 mm.

Radula with tricuspid central and laterals and more or less aculeate marginals; formula, after Taylor,  $(16+12+1+12+16) \times 115$ .

Hab. CAPE PROVINCE. Queenstown (Dower; Roebuck); Kokstad (Cawston).

NATAL. Thornville Junction (Burnup).

A species of almost world-wide distribution, differing externally from *reticulatus* in its colourless mucus, abrupt terminal end of body and large mantle, and internally by absence of the rectatheca and of the digitate gland at apex of penis.

# var. grisea Taylor.

Agriolimax laevis Müll., var. grisea Tayl., Mon. Brit. Moll., ii, p. 126, pl. xv (1906), f. 6. D.F.

Animal in spirit: long. 12.5, lat. 3.5, greenish grey above with slightly yellower tinge beneath, sole pale grey, slightly broader than side areas, greatest breadth 1.7 mm.

Hab. NATAL. Pietermaritzburg (Vet. Serv. S. Africa).

DAMARALAND. Alt Seis, Windhoek District (Edlinger).

Described from Ireland and recorded by Taylor from Finland and Germany.

My very tentative determination of these slugs as this variety is based solely on their close resemblance to Taylor's figure and on other external features: I have not seen specimens from the other localities given above for the typical form.

#### Sub-Family PARMACELLINAE.

Limacidae with a well-developed epiphallus and spermatophore; accessory organs, when present, developed from atrium or vagina; endocones of lateral teeth separate from mesocones; mantle granulose or punctate, its central part limited by a groove.

Cockerell has recently \* proposed a distinct sub-family, Milacinae, for Milax and Aspidophorus, leaving Parmacella and Boettgerilla in the Parmacellinae.

> Genus Milax Gray, 1855 (Cat. Pulm., p. 174). Type Limax gagates Drap. (=Amalia Mog.-Tand., 1855).

Pedal gland in body cavity: right ocular retractor free from penis; genital opening near mantle-edge; mantle of moderate size, wholly concealing the shell, which has a non-spiral median nucleus.

#### Milax gagates (Drap.). Ref. List No. 193.

1801. Limax gagates Drap., Tabl. Moll. Fr., p. 100. D.

1904. Amalia ,, ,, Tayl., Mon. Brit. Moll., ii, p. 139, pl. xv (1906), f. 9-14. D.F.A.R.

1916. Milax gagates Drap., Conn., Ann. S.A. Mus., xiii, p. 184. N. " Watson, J. of C., xix, p. 73, pl. i, f. 6; 1930. pl. ii, f. 4, 6, 16-17. F.A.R.

Animal comparatively slender, usually black to grey above; foot-sole pale; dorsal keel prominent and sharp, extending entire length of back, angulate behind; body with regular, longitudinal grooves, the intervening spaces only slightly granulate; mantle shortly rounded behind; shell elongate oval, white, convex above, apex slightly in rear of centre, encircled by concentric lines of growth,

Long. 4.5, lat. 3 mm.; length of animal about 50-60 mm.

Jaw arcuate, finely striate, with obtuse median projection, central and lateral teeth tricuspid, inner marginals with outer cusp, outer simply aculeate; formula given by Watson  $(29+18+1+17+27) \times 96$ .

<sup>\*</sup> Nautilus, xlviii, 1935, p. 143.

Hab. CAPE PROVINCE. Port Elizabeth (fide Cockerell); Ashton; Storms Vlei (Purcell); George (Vet. Serv. S. Africa).

CAPE PENINSULA. Cape Town (Lightfoot); Cape Flats (Schultze); Simonstown (German South Pole Expedition).

NATAL. Pietermaritzburg (Burnup).

A European species, also recorded from the Atlantic Islands, North and South America, and Australia.

> Milax capensis (Krs.). (Pl. v. f. 15-17.) Ref. List No. 192.

1848. Limax (Limas) capensis Krs., Südafr. Moll., p. 73. D. kraussii (="campestris" Krs.), H. & A. Ad., Gen. rec. Moll., ii, p. 219.

"Animal in alcohol whitish, smooth, slender, elongate, subcylindriform, acuminate behind, with the appearance of a dorsal keel, mantle elongate oval, 22.5 mm. long, smooth, weak, rounded fore and aft, containing at the hind end a solid, rounded oval shell, convex and smooth above, rougher beneath, with irregular concentric and indistinct radial striae, apex on anterior margin, not prominent, length of shell 6.0, lat. 5.1; animal: long. 69.0, lat. 10.0 mm.; respiratory orifice somewhat behind centre of mantle." (After Krauss.)

Hab. CAPE OF GOOD HOPE (Krauss).

Remains of type in Stuttgart Museum.

When Heynemann examined the tube that was supposed to contain the single type specimen of this species there remained nothing but the shell, which, he said, is very similar to that of M. marginatus, solid, not membranaceous on border, regularly oval with tendency towards quadrangulation, and nucleus on central line. It is now halfcovered with a calcareous deposit which it would be unsafe to remove; it is  $4.5 \times 3.0$  mm. and apparently consists of a smooth nucleus nearly 3 mm. in length, after which it bears about 9 growth lines following the hinder curve of the nucleus, but it has obviously undergone considerable change since the time of Krauss' original description.

> Milax ponsonbyi (Clige.). Ref. List No. 194. (Pl. xiv, f. 3.)

1900. Amalia ponsonbyi Cllge., Ann. S.A. Mus., ii, p. 2, pl. i, f. 1-2; pl. ii, f. 13. D.F.A.

Animal sepia blue on mantle and back, gradually shading to yellowish down the sides, groove on mantle well marked, keel well developed, rugae small, sulci faint, sepia coloured, peripodial groove narrow, but distinct, foot-sole yellowish, divided into median and lateral planes.

Length in alcohol 32 mm.

Shell calcareous, ovoid, slightly broader behind the middle: Long 5.0, lat. 3.2 mm.

Hab. CAPE PENINSULA. Cape Town (Lightfoot).

Type in Cambridge Museum.

Externally this slug is said to be not unlike some forms of gagates, but that the generative organs prove them to be distinct.

#### FAMILY ARIONIDAE.

Slugs with mantle restricted to anterior and middle part of body; radular teeth with quadrate basal plates; foot with peripodial grooves; kidney more or less surrounding the heart.

### Sub-Family ARIONINAE.

Shell internal or practically absent; jaw ribbed; cephalic retractors arising separately.

Genus *Arion* Fér., 1819 (Hist. Moll., i, pp. 50, 53).

Type A. empiricorum Fér.

Slugs with rounded dorsum and somewhat corpulent body, rugose skin, blunt and unkeeled tail, foot with pedal groove and caudal mucous pore, mantle anterior, granulate, rounded at each end, with respiratory orifice near its right fore-end and genital opening beneath; shell usually a soft calcareous secretion; the chief internal characteristics are the crowding of the main mass of the genitalia into the fore-half of the body, and absence of a penis, its intromittent functions having been usurped by the vagina.

## Arion intermedius Normand. Ref. List Nos. 209, 210.

1852. Arion intermedius Norm., Descr. Lim. nouv., p. 6. D.

1885. , *minimus* Srth., Zeitschr. Wiss. Zool., xlii, pp. 237, 289, pl. vii, f. 41; pl. xi, f. 18–23. *D.F.A.R.* 

1900. Arion fuscus Müll., Cl<br/>lge., Ann. S.A. Mus., ii, p. 7.  $\, L. \,$ 

1906. ,, intermedius Norm., Tayl., Mon. Brit. Moll., ii, p. 240, pl. xxiv (1907), f. 18–23. D.F.A.R.

1910. Arion fuscus Müll., Cllge., Ann. Natal Mus., ii, p. 170. L. 1916. ,, ,, and intermedius Norm., Conn., Ann. S.A.

Mus., xiii, p. 185. N.

Animal small but plumply built, hinder end very blunt; foot-sole undivided, caudal pore inconspicuous, body tubercles shortly polygonal, surmounted in life by short, white, glandular spikes, of which, however, there is no sign in spirit material from South Africa, respiratory opening almost median, genital opening below and nearly midway between pulmonary orifice and base of right tentacle, shield finely granulate, rounded at ends, about one-third as long as body, colour of animal yellowish grey, usually with a faint, slightly darker band along each side, sole yellowish, fringe yellowish grey.

Length seldom exceeding 20, width when extended 3½, though in contracted

spirit examples nearly 5 mm.

Jaw not much curved, with broad ribs, radula formula fide Taylor  $(34+1+34) \times 98$ , central tricuspid, inner laterals weakly so, gradually losing the endocone, marginals bicuspid. Shell vestigial, but said to be sometimes white, opaque, and rugate.

Hab. CAPE PENINSULA. Cape Flats (Schultze); Cape Town and Table Mountain (frequent).

NATAL. Pietermaritzburg (Burnup).

Such Cape Town examples as I have seen agree in colour with Taylor's figure (l.c., p. 244, pl. xxiv, f. 22) of var. normalis Moq.-Tand., uniform yellow with blackish head and tentacles.

As there existed some doubt as to whether the slugs attributed by Simroth to intermedius and by Collinge to fuscus might refer in reality to only a single species, I communicated my doubts to the latter, whose kind reply I quote hereunder, as its conciseness and authority carry greater weight than any expression of my own views, and afford conclusive grounds for eliminating fuscus from the South African list: "In reply to your letter I have very distinct recollections of the Arion fuscus; they proved very puzzling and I could not make them agree with our British intermedius. With a wider knowledge now of this latter species I should certainly place the S. African specimens under it."

A. intermedius is endemic in Europe and probably the Azores; it is also recorded from New Zealand, where its introduction, as into South Africa, is doubtless due to commerce.

#### Arion hortensis Fér.

#### (Pl. xiv, f. 5.)

1820. Arion hortensis Fér., Hist. Moll., ii, p. 65, pl. ii, f. 4-5. D.F. " Tayl., Mon. Brit. Moll., ii, p. 210, 1905. pl. xxiv (1907), f. 7-11. D.F.A.R.

1926. Arion (Prolepis) hortensis Fér., K. & W., Syn. Brit. Moll., p. 161. Ref. List.

Animal about 30 mm. long when extended, normally dark slate-grey, darkest mid-dorsally, and with a conspicuous darker band on each side, sharply defined above, but not below. Body less blunt in rear than in *intermedius*, about 24 longitudinal rows of tubercles on each side, shield rounded in front and broadly so in rear, finely shagreened, the dark lateral band continuing and arching over the respiratory orifice; head and tentacles dark, neck pale, sole not visibly tripartite, normally orange or deep yellow, fringe bearing slight transverse furrows. Shell usually vestigial but sometimes solid.

Jaw crossed by about 10 ribs; radula formula, fide Taylor  $(26+10+1+10+26) \times 116$ , central strongly tricuspid, laterals obscurely so but lacking the endocone cutting point, inner marginals unicuspid, later with ectocone, outermost very small.

Hab. CAPE PENINSULA. Newlands, Table Mountain (Barnard and others).

A well-known European species now acclimatised in the United States; Taylor includes in synonymy lineatus Risso, anthracius Bgt., pelophilus and distinctus Mab., pyrenaicus Fagot, alpensis Fitz., cotteanus Pollon., elongatus and coeruleus Clige.

#### Sub-Family OOPELTINAE.

Animal without inner shell, tapering behind, without caudal pore, foot-sole usually undivided, mantle rather small, ovate, respiratory orifice slightly in front of middle; jaw smooth, with weak central projection, central tooth tricuspid, laterals with ectocones, marginals with short cusps.

Genus *Oopelta* Mörch, 1867 (Mal. Blätt., xiv, p. 191). Type *O. nigropunctata* Mörch.

Characters as in the subfamily. The specific determination of these slugs follows that of Collinge in his papers of 1900 and 1901, but the genus now probably needs careful revision, as Pollonera was unacquainted with what Collinge had written and the status of the two species he described is doubtful, and I have seen at least two or more forms which appear to be new, but without knowledge of whose anatomy it is inadvisable to describe them.

Oopelta nigropunctata Mörch. Ref. List No. 207. (Pl. xiv, f. 8.)

1867. Oopelta nigropunctata Mörch, Heynem., Mal. Blätt., xiv, p. 191, pl. ii, f. 1–2. D.R.

1900. Oopelta nigropunctata Mörch, Cllge., Ann. S.A. Mus., ii, p. 5, pl. i, f. 7–8; pl. ii, f. 16. D.F.A.

Animal yellowish green, paler on sides, body marked by a series of oblique posteriorly directed grooves,  $2-2\frac{1}{2}$  mm. apart; mantle oval, granulate, spotted with an irregular series of few or rather more black dots; slight trace of keel; rugae small, peripodial groove distinct.

Length in alcohol 50.0, mantle 21 mm. (after Collinge).

Central tooth of radula figured by Heynemann with 2 small side cusps, laterals to about No. 33 with ectocone, marginals from about the 36th tooth practically cuspless.

Hab. CAPE PENINSULA. Bergvliet (Schultze); Cape Town (Lightfoot).

CAPE PROVINCE. Albany District (Penther); Sir Lowry's Pass (Connolly).

Described from Guinea, the type measuring: long. 24, alt. 11; mantle long. 14, lat. 8-9; sole lat. 7 mm.

## Oopelta flavescens Clige. Ref. List No. 204.

1900. *Oopelta flavescens* Cllge., Ann. S.A. Mus., ii, p. 6, pl. i, f. 9–10; pl. ii, f. 17. *D.F.A.* 

Animal cream-coloured, with a slight bluish-green tint on posterior portion of mantle, granulation prominent, rugae small, oblique grooves as in preceding species, no trace of keel, peripodial groove distinct.

Length in alcohol 51.0, mantle 22.0 mm.

Hab. CAPE PENINSULA. Kalk Bay (type, Purcell).

CAPE PROVINCE. Caledon; Swellendam; Kogman's Kloof, Ashton (Purcell).

Type in Cambridge Museum.

The colour is variable, the head being sometimes bright orange, accompanied by a narrow yellow dorsal line from end of mantle to tip of tail; Lightfoot noticed this slug to change in the dark to a dark olive hue.

# Oopelta granulosa Clige.

Ref. List No. 205.

1900. *Oopelta granulosa* Cllge., Ann. S.A. Mus., ii, p. 6, pl. i, f. 11–12; pl. ii, f. 18. *D.F.A*.

Animal brownish yellow, head and sides anteriorly bluish, granulation on mantle very pronounced, rugae small but prominent, giving the whole body a coarse granulate appearance; no trace of keel, oblique grooves as in preceding species, peripodial groove distinct.

Length in alcohol 42·0, mantle 18·5 mm.; a larger specimen measures 64·0, mantle  $31\cdot5$  mm.

Hab. CAPE PROVINCE. Nieuwondtville (type, Leipoldt); Montagu (Purcell); Sir Lowry's Pass (Connolly).

Type in University Museum of Zoology, Cambridge.

Oopelta aterrima (Gray).

Ref. List No. 202.

1855. Arion aterrimus Gray, Cat. Pulm., p. 55. D.

Animal in alcohol much contracted, entirely black, oblique grooves practically invisible except for about 5 radiating from the rear of mantle towards the tail and fringe, mantle scarcely granulate, ovate, rounded in front, broadly and bluntly angulate at a little more than a right angle in rear, no dorsal keel or caudal mucous pore, sole undivided, peripodial groove distinct, respiratory orifice about median.

Long. 37.0, alt. 18.0, sole lat. 10.5 mm.

Hab. SOUTH AFRICA (fide Gray).

Type in British Museum.

Oopelta polypunctata Clige.

Ref. List No. 208.

1901. *Oopelta polypunctata* Cllge., Ann. S.A. Mus., ii, p. 232, pl. xiv, f. 3-4, 7-10. *D.F.A*.

Animal greyish yellow, oblique grooves as in *O. nigropunctata*, mantle ovoid, slightly produced to front and rear, greenish, spotted with numerous (43–71) black dots. Dorsum flattish, no trace of keel, tail flattened and produced towards the tip, rugae small, peripodial groove distinct.

Length in alcohol 52.0, mantle 19 mm.

Hab. CAPE PROVINCE. Zonder End, Caledon Division (Purcell). Type in Cambridge Museum.

In external appearance resembles pale examples of *nigropunctata*, but there are more black dots on the mantle, and according to Collinge the form of the generative organs, especially the sperm-duct, is very distinct.

Oopelta capensis Pollon.

Ref. List No. 203.

1909. Oopelta capensis Pollon., Boll. Mus. Torino, xxiv, 608, p. 11, pl. i, f. 1-6. D.F.A.R.

"Animal pale earth-coloured, mantle bearing irregular black dots, large, closely granulose, posteriorly cuneiform and obtuse-angulate, respiratory orifice in front of middle, dorsum rugosely granulate, not keeled, carinal region defined by 2 subparallel grooves, lateral grooves obliquely transverse, somewhat distant."

Length of back behind mantle 13.0, mantle 14.5, foot-sole 29 mm.

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Hab. CAPE PENINSULA. Cape Town (in Mus. Torino).

Type in Turin Museum.

Teeth of radula as in the genus. The slug is said to differ from nigropunctata through larger size and back without keel.

## Oopelta minor Pollon. Ref. List No. 206.

1909. *Oopelta minor* Pollon., Boll. Mus. Torino, xxiv, 608, p. 12, pl. i, f. 7–8. *D.A.* 

Said to differ from capensis through much smaller size, ashen-coloured back with obtuse keel, and shortly cuneiform mantle.

Length of back behind mantle 7.5, mantle 9.0, foot-sole 17.5 mm.

Hab. CAPE PENINSULA. Cape Town (in Mus. Torino).

Type in Turin Museum.

Pollonera deals with the anatomy of his two species and nigropunctata, pointing out the features which cause him to think them distinct.

#### FAMILY ENDODONTIDAE.

Shell corneous, small to medium, usually heliciform or depressed, sometimes with apertural or internal dentition; foot with lateral grooves; jaw striate, folded, or composed of several small plates, central and lateral teeth usually tricuspid, marginals with one (rarely) or more outer cusps and quadrate basal plates; genitalia usually without special appendages.

#### Sub-Family Endodontinae.

Foot normally without caudal pore; jaw folded or striate; central tooth usually with narrow mesocone and clear ectocones, rarely lacking, laterals with or without endocone, marginals usually tricuspid, but sometimes with 2 or more small outer cusps.

Genus Trachycystis Pilsb., 1893 (Manual, viii, p. 136, and ix, p. 37). Type Helix bisculpta Bs.

(=Pella Albers, 1860, non Stephens, 1835).

Shell of medium size to minute, usually heliciform and corneous,

with or without bristles, aperture edentate, periphery rounded or carinate.

Animal with foot fringe cut off by well-marked peripodial grooves, genital opening far forward on side of head. Kidney about twice as long as pericardium, curving up posteriorly to rectum; ureter continuing forward beneath rectum as a secondary ureter. Genital system characterised by a very long, unbranched, receptacular duct, often swollen anteriorly, a narrow free oviduct, a well-developed epiphallus without flagella, and usually a rather broad penis. Jaw thin, generally folded, radula with about 120 to 200 nearly straight rows of teeth of the quadrate type, central tricuspid, with long mesocone and short ectocones, laterals also tricuspid, like the central but very slightly larger, about 9 to 16 on each side, with very gradual transition to the marginals, of which there are about 11 to 46 a side, more asymmetrical, with shorter and relatively broader basal plates and sometimes more than 3 cusps owing to the splitting of ectocone or more rarely endocone.

Long prior to the appearance of Watson's recent paper I had divided the members of this genus into several groups on purely conchological grounds, and it is satisfactory to find that the ten sub-genera in which Watson has placed such of these as he has examined anatomically and named do little to disturb my arrangement. I propose therefore to adhere substantially to my grouping in the following pages, subject to modification necessitated by his researches and with mention of such species as he has assigned to any of the ten sub-genera.

# (i) Group of bisculpta Bs. Sub-genus Trachycystis Pilsb., s.s.

Foot of animal long and narrow, with a prominent serrated keel running along the top of the hinder part. Duct of spermatheca not enlarged anteriorly, female ducts as a rule unusually slender; epiphallus remarkably short and swollen, entering posterior end of the large penis; insertion of penial retractor muscle extending from hinder end of penis for a short distance down one side. Central and lateral teeth of radula with the anterior end of the long basal portion of mesocone very narrow in bisculpta (Bs.) and jucunda Conn. or absent in tollini (Bs.) and proxima Conn. Endocones and mesocones of marginals about equal in length, both extraordinarily long and pointed; ectocones small and single, absent from inner marginals of adult tollini and proxima.

## Trachycystis bisculpta (Bs.). Ref. List No. 233.

1851. Helix bisculpta Bs., A.M.N.H., vii, p. 103. D.

1893. Phasis (Trachycystis) bisculpta Bs., Pilsb., Manual, ix, pp. 37, 38, pl. x, f. 5-7; pl. xv, f. 3-4. F.A.

1934. Trachycystis bisculpta Bs., Watson, Proc. Mal. Soc., xxi, pp. 165, 177, f. 2A, pl. xx, f. 11-12. N.A.R.

Shell of fair size, depressed globose, narrowly umbilicate, thin, silky, corneous red or yellowish brown. Spire not much raised, apex obtuse. Whorls 5, convex, rounded at the periphery, rather rapidly increasing, the first 1\frac{1}{4} sculptured almost into the extreme apex with from 6 to 8 strong microscopic spiral costulae, which are crossed on the last \(\frac{1}{4}\) whorl by close transverse striae; from that point the sculpture changes to a pattern of rather close, regular, slightly curved and oblique transverse costae, the intervals between which are filled with from 4 to 5 faint parallel striolae, intersected by microscopic spiral lines, a little more distant than, but about equal in strength to the striolae; on the base the costae merge closer together into the umbilicus, so that the spirals almost disappear; suture simple, well defined. Aperture \(\frac{3}{4}\)-lunar, descending at the base, peristome simple, acute, labrum nearly straight and scarcely receding in profile, columella concave, margin very narrowly reflexed, but half obscuring the narrow umbilicus.

Diam. maj. 7.6, min. 6.7; alt. 6.0; apert. alt. 3.8, lat. 4.1 mm.

Hab. CAPE PENINSULA. Camps Bay (type, Benson); widely distributed from Lion's Head to Cape Point (Layard).

CAPE PROVINCE. Caledon (Connolly); Riversdale; Riebeek Kasteel Mts., 2800 feet; Palmiet R. Mts., 3000 feet; Bredasdorp; Wellington Mts., 5000 feet (Barnard).

Originals in University Museum of Zoology, Cambridge.

Shell described from Kommetje in my collection.

A beautiful variety with white translucent shell from Signal Hill, Cape Town (Lightfoot), is in the South African Museum.

The shells from the more easterly districts are of darker, more rufous hue than the majority of those from the Cape Peninsula and Caledon, while the Bredasdorp form is particularly large, containing 6 whorls and measuring: diam. maj. 10.8, min. 9.5; alt. 7.3; apert. alt. 5·2, lat. 5·3 mm.

# Trachycystis tollini (Bs.).

Ref. List No. 278.

1855. Nanina afra Pfr., Mal. Blätt., ii, p. 119 (without characters).

1856. Helix tollini Alb., Bs., A.M.N.H., xviii, p. 436. D.

roseri Krs., Mts., Die Helic., p. 84 (without char-1860. acters). L.

1892. Helix (Pella) tuguriolum M. & P., A.M.N.H., ix, p. 88, pl. v. f. 5. D.F.

1934. Trachycystis tollini Alb., Watson, Proc. Mal. Soc., xxi, pp. 163, 164, 165, 166, 167, pl. xx, f. 13. N.A.R.

Shell comparative large, depressed globose, rimate, smooth to the eye, glossy, transparent, corneous reddish or yellowish brown, varying in shade. Spire little exserted, apex obtuse. Whorls nearly 6, convex, regularly increasing, the first  $1\frac{1}{2}$  sculptured almost to the extreme apex with close, regular, spiral striolae, remainder covered with close, very slightly curved and oblique, weak, flattish transverse striae, crossed by the spiral sculpture, which is easily discernible under a weak hand-lens and becomes undulating on the later whorls and base; suture simple, well defined. Aperture narrowly \(\frac{3}{4}\)-lunate, slightly descending, columellar margin, though extremely narrowly reflexed, almost obliterating the minute rima.

Diam. maj. 13.0, min. 12.0; alt. 9.2; apert. alt. 6.8, lat. 6.7 mm.

CAPE PROVINCE. Stellenbosch (Purcell); Houw Hoek (Connolly); Gordon's Bay; Hermanus (Lightfoot); Bredasdorp (Layard); Swellendam District (roseri, Krauss); Riversdale (Barnard).

CAPE PENINSULA; tollini and tuguriolum; generally distributed. Originals of tollini in University Museum of Zoology, Cambridge; types of afra and tuguriolum in British, roseri in Stuttgart Museum.

Description founded on specimens from Cape Peninsula in my collection.

One of the largest species of the genus; Barnard's set from Swelllendam Mountains are dark red-brown, and the spiral striae on the last 2 whorls are very much stronger, and in some examples more distant than in the Cape Town race; however, this feature varies in different individuals, and the sculpture on the earlier whorls and base being similar to that of tollini, I hesitate to differentiate them unless warranted by future anatomical research.

> Trachycystis rubra Conn. (Pl. vi, f. 20-22.)

1925. Trachycystis rubra Conn., A.M.N.H., xv, p. 469, pl. xxviii, f. 7. D.F.

Agrees in practically every respect with the foregoing, but the spiral striae, while very strong on the protoconch, are hardly visible under 20-fold magnification on the later whorls, which are covered with close, regular, straight transverse costulae, strong above and weaker on the base, the intervals filled with 4 or 5 fine parallel microscopic striolae. The shell is of bright red colour, contains 6 whorls, and measures

Diam. maj. 10.0, min. 9.2; alt. 7.8; apert. alt. 5.1, lat. 5.5 mm.

Hab. CAPE PROVINCE. Oudebosch, River Zonder End Mts. Caledon Division (Barnard). Type in South African Museum.

#### Trachycystis proxima nom. nov.

1931. Trachycystis approximans Conn., A.M.N.H., viii, p. 308, pl. x, f. 2-4. D.F.

1934. Trachycystis approximans Conn., Wats., Proc. Mal. Soc., xxi, pp. 165, 166. D.N.R.

Resembles bisculpta in colour and appearance, but is barely subrimate. Five moderately convex whorls, first 1½ showing in extremely fresh specimens the spiral sculpture of the sub-genus, but it is much fainter and very evanescent, practically undiscernible under ordinary microscopic magnification when the apex is even moderately worn; remainder covered all over with fine, close, regular, nearly straight, scarcely oblique transverse costulae, the interstices filled by 4-6 extremely fine microscopic striolae, and the whole crossed by even fainter spiral grooves, only visible under high magnification. Columellar margin very narrowly and almost adnately reflexed.

Diam. maj. 7.0, min. 6.2; alt. 5.1; apert. alt. 4.0, lat. 4.0 mm.

Hab. CAPE PROVINCE. George bush (type) and Keurbooms R. bush (Barnard).

Type in South African Museum.

In the radula of adult examples the inner marginals are without ectocones.

When describing this species in 1931 I overlooked the existence of Trachycystis approximans Preston, 1911; I therefore rename it as above.

#### Trachycystis jucunda Conn.

1929. Trachycystis jucunda Conn., Ann. Natal Mus., vi, p. 228, pl. xiv. f. 19-21. D.F.

1934. Trachycystis jucunda Conn., Watson, Proc. Mal. Soc., xxi, p. 165. N.R.

Smaller and flatter than others of the sub-genus, with narrower, more compressed whorls, of which there are 5, convex, gradually increasing, first 1½ with closer, weaker spiral sculpture than the more typical species, remainder with strong, close, regular, slightly curved, oblique transverse costae, interstices filled with fine microscopic parallel striolae and spiral costulae, which are lower, as a rule, than the costae and rarely cross them; suture deep; umbilicus narrow, but uncovered; colour of shell yellowish brown.

Diam. maj. 5·3, min. 5·0; alt. 3·8; apert. alt. 2·7, lat. 2·5 mm.

Hab. CAPE PROVINCE. Montagu (type, Connolly); Swellendam Mts. (Lawrence & Hesse).

Type in British Museum.

I should have hesitated to place the last two species in the present sub-genus were it not that Watson finds their anatomy to correspond with it.

(ii) Group of charybdis Bs.
Sub-genus Cyclocystis Watson, 1934
(Proc. Mal. Soc., xxi, p. 167).
Type Helix charybdis Bs.

Shell discoid, radially costate; protoconch with numerous fine spiral striae crossed by well-marked radial ribs, except on first half whorl.

Hinder part of foot rounded above, not keeled; duct of spermatheca enlarged anteriorly; epiphallus short, entering hinder end of the broad anterior part of penis, which is produced into a pocket or short diverticulum beside the atrium. Posterior to the entrance of the epiphallus the penis is continued in the form of a long and narrow appendix, to the extremity of which the short penial retractor is attached.

Mesocones of central and lateral teeth but little narrowed anteriorly; those of marginals long, broadly rounded at end; endocones much smaller, pointed, and basally united with mesocone; ectocones small and sometimes double in a few of the outer teeth.

# Trachycystis charybdis (Bs.). Ref. List No. 237.

1856. Helix charybdis Bs., A.M.N.H., xviii, p. 436. D.

1899. ,, ,, M. & P., A.M.N.H., iv, p. 194, pl. iii, f. 16. N.F.

1934. Trachycystis charybdis Bs., Watson, Proc. Mal. Soc., xxi, p. 167, pl. xx, f. 14–16; pl. xxi, f. 40. D.A.R.

Shell of fair size, discoid, openly though not very widely umbilicate, asperate, rufous or yellowish corneous brown. Spire impressed. Whorls  $5\frac{1}{2}$ , regularly increasing, convex, shouldered around the suture and umbilicus, and each ascending above its predecessor, the first  $\frac{1}{2}$  whorl smooth, next  $\frac{1}{2}$  or  $\frac{3}{4}$  covered with extremely fine microspiral lines and very close, straight, fine transverse costulae, which develop into very strong, straight, prominent costae, gradually becoming farther apart, and only merging together when entering the umbilicus, the interstices between them filled with very faint microscopic parallel transverse striolae; suture impressed. Aperture narrowly  $\frac{3}{4}$ -lunate, slightly descending, peristome simple, acute, labrum straight and vertical in profile, columella concave, upper margin scarcely reflexed, not overhanging the umbilicus.

Diam. maj. 8.8, min. 7.8; alt. 5.0; apert. alt. 4.0., lat. 4.1 mm.

Hab. CAPE PENINSULA. Table Mountain and Kalk Bay Mt. (Layard).

CAPE PROVINCE. Palmiet R. Mts., 2000 feet (Barnard).

Originals in University Museum of Zoology, Cambridge. Shell described, from Table Mountain, in my collection.

A beautiful species, distinct in the genus from others of its size through its deeply impressed spire.

> Trachycystis vorticialis (Bs.). Ref. List No. 281.

1850. Helix vorticialis Bs., A.M.N.H., v, p. 216. D.

Shell rather small, depressed orbicular, umbilicate, thin, translucent, reddish corneous. Spire flattened. Whorls 41, rounded, gradually increasing, the last very slightly descending, all but the apical covered with close, nearly straight, regular, transverse lirae, which are equally strong above and below and extend into the umbilicus; there is clear microspiral lineation on the 2nd whorl, but not discernible elsewhere on the slightly weathered shells available for my examination; suture deep. Aperture rounded lunate, labrum receding but little towards the base, peristome simple, acute, columella concave, margin scarcely reflexed, not approaching the rather wide umbilicus.

Diam. maj. 5·3, min. 4·8; alt. 2·75 mm.

Hab. CAPE PENINSULA. Three Anchor Bay; Rondebosch; False Bay (fide Benson); "Generally distributed" (Layard).

CAPE PROVINCE. Port Elizabeth (?) (fide Sturany).

Specimen described, from Table Mountain, in South African Museum. Type in British Museum.

Differs from charybdis through its inferior height and the fact that its spire, though flattened, is not concave, as is invariably the case in the other species. The actual height of the body whorl in front is only 2.3 mm., while in *charybdis* of the same diameter it is 2.8 mm.

In common with other helicoids apparently plentiful fifty years ago, the present species, probably owing to the encroachments of house-builders and the introduction of Cryptomphalus aspersa and Theba pisana, appears to have become extremely scarce in the Cape Peninsula, though there is reason to hope that some of these otherwise expiring races may be rediscovered eventually in the more or less "near-by" districts wherein Barnard has recently collected T. charybdis and bisculpta.

> (iii) Group of burnupi M. & P. Sub-genus Chalcocystis Watson, 1934 (Proc. Mal. Soc., xxi, p. 169). Type Helix aenea Krs.

Hinder end of foot keeled, the keel rather prominent and serrate in aenea, but relatively low and inconspicuous in burnupi; epiphallus VOL. XXXIII. 13

entering side of fusiform penis; retractor of right upper tentacle situate on left of penis instead of passing between penis and vagina, as it does in all other sub-genera so far examined. Radula little specialised; marginals with blunt mesocones of moderate length, smaller endocones, and ectocones that are double in some of the outer teeth of burnupi.

Only two species, aenea and burnupi, so far described and one now proposed as new belong to this group, and as burnupi has been widely distributed and is well known, while aenea has until now been little understood, it may facilitate comparison to give pride of place hereunder to

Trachycystis burnupi (M. & P.). Ref. List No. 234.

1892. *Helix* (*Pella*) *burnupi* M. & P., A.M.N.H., x, p. 239, pl. xiii, f. 6. D.F.

1894. *Pella burnupi* M. & P., Suter, A.M.N.H., xiii, p. 60, pl. v, B, f. 1, 2. *A.R.* 

1934. Trachycystis burnupi M. & P., Watson, Proc. Mal. Soc., xxi, pp. 163, 166, 169, pl. xx, f. 19. N.A.R.

Very similar in form to bisculpta, but the whorls increase a little more rapidly; narrowly umbilicate, corneous yellow-brown, with flattish spire and 4 convex whorls, rounded at periphery, protoconch,  $1\frac{1}{2}$  whorl, micropunctate, remainder covered all over with strong, close, regular, slightly curved transverse costae, with about 6 faint parallel microscopic striolae in the intervals and no spiral sculpture; suture simple, impressed. Labrum gently curved and receding very slightly in profile, upper margin of columella very narrowly reflexed, scarcely overhanging the narrow umbilicus. The shell described from Pietermaritzburg measures

Diam. maj. 7.2, min. 6.2; alt. 4.5; apert. alt. 3.8, lat. 3.5 mm.

Hab. NATAL. Pietermaritzburg District (type, Burnup). ZULULAND. False Bay (Bell Marley).

Type in British Museum.

Although it will be shown hereunder that this species is distinct from aenea Krs., the differences in the shell are but little prominent when the latter is not fully developed, as is the case in the Kraussian type, while both species occasionally occur in the same neighbourhood and have been distributed by Burnup together under the name of burnupi; it was not surprising, therefore, that in course of time, from study of the original description of aenea, not only Burnup, but M. & P. began to doubt the validity of their own species, and when a very well-known authority was about to visit Stuttgart Museum some few years ago I entrusted to him specimens of burnupi, which he most kindly consented to compare with the type of aenea, with

the result that he reported them to be identical, and I placed them in synonymy in 1925. During recent years, however, a fine series of the true aenea, collected by Puzey about the original locality, proves that the shells themselves tend to grow more unlike as they increase in size, while Watson has shown that the anatomy of the two species is also distinct. On the whole it may be said that burnupi is rather localised in the interior of Natal, while aenea extends far more widely along or near the coast, but this is not invariably the case.

## Trachycystis aenea (Krs.). Ref. List No. 228.

1848. Helix aenea Krs., Südafr. Moll., p. 75, pl. iv, f. 18. D.F.

1925. Trachycystis aenea Krs. (=burnupi M. & P.), Conn., Trans. R. Soc. S. Africa, xii, p. 141. N.

1934. Trachycystis aenea Krs., Watson, Proc. Mal. Soc., xxi, pp. 163, 164, 166, 169, pl. xx, f. 17-18. N.A.R.

Attains much larger dimensions than burnupi, more dome-shaped and consequently of comparatively greater altitude, with far narrower umbilicus; the whorls increase a trifle more rapidly and the costae are infinitesimally farther apart; suture slightly more shallow and aperture more nearly circular and descends somewhat, whereas in burnupi it is almost horizontal; upper margin of columella triangularly reflexed, more than half obscuring the narrow umbilicus. My largest example from Durban, with 4½ whorls, measures

Diam. maj. 11.4, min. 10.0; alt. 8.5; apert. alt. 6.3, lat. 5.7 mm.

Hab. NATAL (type, Wahlberg); Durban (Puzey); Pietermaritzburg (Burnup).

LORENZO MARQUES. Cape Delagoa (Plant); Delagoa Bay (Connolly).

Type in Stuttgart Museum.

The original pair are only about 8 mm. in major diameter, but agree with the foregoing description; immature or rather flat-spired examples of this species can be readily separated from burnupi by their narrower umbilicus.

# Trachycystis viridula sp. n. (Pl. vi, f. 14–16.)

Spire a trifle less exserted than in burnupi and consequently far less domed than in aenea; whorls slightly less convex, and increasing a trifle more rapidly, so that their upward slope is more gentle. The perforation is a trifle less covered by the columellar margin than in aenea and far more so than in burnupi, and the colour, especially on the later whorls, of a distinct greenish hue. The type, with  $4\frac{1}{2}$ whorls, measures

Diam. maj. 8.7, min. 7.5; alt. 5.3; apert. alt. 4.5, lat. 5.0 mm.

Hab. CAPE PROVINCE. Seven Weeks Poort, Zwartberg Mts., Ladismith, 7000 feet (Barnard).

Type in South African Museum.

Although at first glance this species might well be referred to the Natalian aenea Krs., it will be seen from the foregoing comparison that it differs from both it and burnupi in certain particulars in divergent directions, which, together with its geographical position, seems to indicate specific distinction, though I place it without hesitation in the same sub-genus. Its spire is less exserted than in the other two species, and its greenish colour, in all specimens yet to hand, very different from their golden hue.

 (iv) Group of simplex M. & P., including Sub-genus Phaulocystis Watson, 1934
 (Proc. Mal. Soc., xxi, p. 171).

 Type Helix aulacophora Ancey.

Hinder part of foot more or less rounded above, not keeled; duct of spermatheca slightly enlarged at anterior end; vagina longer than in any other known sub-genus of *Trachycystis*. Epiphallus long or of medium length, entering penis at its posterior end close to attachment of penial retractor; penis subcylindrical, without appendix or posterior continuation.

Teeth of radula slightly shorter and broader than in most groups; mesocones of central and laterals but little narrowed anteriorly; those of marginals conical and of no great length; endocones smaller; ectocones still shorter, but usually divided into 2 small cusps in some of the outer teeth.

Watson places here on anatomical grounds aulacophora Ancey, turmalis Morel., and a form probably referable to spissicosta M. & P., which fall well within the limits of the very homogeneous group mentioned above, all of which probably belong to the same sub-genus; the colour of all is corneous- or red-brown, and the shell is not glossy, owing to the more or less strong costulate sculpture which imparts to it a dull, silky appearance; the apex is usually without noticeable spiral sculpture.

Trachycystis simplex M. & P. Ref. List No. 274.

1903. Trachycystis simplex M. & P., A.M.N.H., xii, p. 604, pl. xxxii, f. 7. D.F.

Shell of fair size, subglobose, narrowly umbilicate, thin, asperate, pale corneous brown. Spire moderately exserted, apex nearly flat. Whorls 5, convex, the 1st smooth, minute, remainder regularly increasing, sculptured all over, into the umbilicus, with strong, curved, oblique costulae, closer and weaker on the 2nd and strong and more distant on the others, on which the intervals between them are filled with from 6 to 8 microscopic striolae; suture simple, well defined. Aperture \frac{3}{4}-lunate, peristome simple, acute, labrum receding in a gentle curve, columella concave, upper margin extremely narrowly reflexed, not obscuring the narrow, but deep umbilicus; callus none.

Diam. maj. 7.4, min. 6.5; alt. 5.4; apert. alt. 3.7, lat. 3.7 mm.

Hab. CAPE PROVINCE. Pondoland (type); Grahamstown (Farquhar); East London (Power); Keurbooms R. bush, Plettenberg Bay (Barnard).

Type in British Museum.

Shell described from East London in my collection.

# Trachycystis spissicosta M. & P. Ref. List No. 276.

1907. *Trachycystis spissicosta* M. & P., A.M.N.H., xix, p. 100, pl. vi, f. 13. *D.F.* 

A rather smaller form than simplex, with an almost flat spire, slightly larger umbilious, and much less rapidly increasing whorls. Of these there are  $4\frac{1}{4}$ , rounded at the periphery, with similar sculpture to simplex, but the costae are very slightly closer together, though more distant on the 2nd whorl, than in simplex. A fine topotype in my collection measures

Diam. maj. 7.0, min. 6.0; alt. 4.4; apert. alt. 3.2, lat. 3.2 mm.

Hab. CAPE PROVINCE. Grahamstown (type, Farquhar). O.F.S. Thaba N'chu (Connolly). Type in British Museum.

# Trachycystis lignicola M. & P. Ref. List No. 252.

1898. Trachycystis lignicola M. & P., A.M.N.H. ii, p. 125, pl. vii. f. 1. D.F.

Smaller than the last two, with a spire of intermediate height and a narrower umbilicus.  $4\frac{1}{2}$  convex whorls, gradually increasing, the first  $1\frac{1}{2}$  practically smooth, remainder covered all over with extremely close, faint, regular, curved striae.

Diam. maj. (topotype in my collection) 5.0, min. 4.5; alt. 3.2; apert. alt. 2.5, lat. 2.1 mm.

Hab. CAPE PROVINCE. Fish River, Cradock (type), and Mountain Drive, Grahamstown (Farquhar).

Type in British Museum.

## Trachycystis eupleura Conn.

1925. Trachycystis eupleura Conn., A.M.N.H., xv, p. 470, pl. xxviii, f. 7. D.F.

1934. Trachycystis eupleura Conn., Watson, Proc. Mal. Soc., xxi, pp. 176, 177, f. 2, B. N.R.

A comparatively small species with a nearly flat spire and  $4\frac{1}{2}$  flattish, regularly increasing whorls. The sculpture is very similar to that of spissicosta, but the wide, open umbilious distinguishes it easily from all of this group.

Diam. maj. 4.8, min. 4.1; alt. 2.2; apert. alt. 1.9, lat. 1.8 mm.

Hab. CAPE PROVINCE. Majuba Nek, Herschel Div. (type, Hepburn).

GREAT NAMAQUALAND. Bremen Farm, Warmbad District (subfossil, Haughton).

Type in Albany Museum.

The central and lateral teeth of radula have peculiarly swollen mesocones, arising from the basal plate practically independent of endocones and ectocones, and each marginal has 3 cusps almost equal in length.

I place this species here for conchological convenience, but the shell is less compact and more widely umbilicate than others of the group and the radula proves it subgenerically distinct from *Phaulocystis*. Watson has stated that the Warmbad race is at least subspecifically distinct from type owing to the presence of a keel, which dies out on the last whorl, but material at present to hand does not appear to me to justify such distinction.

# Trachycystis oreina M. & P.

Ref. List No. 260.

1903. Trachycystis oreina M. & P., A.M.N.H., xii, p. 602, pl. xxxii, f. 8. D.F.

A small shell with a moderately exserted spire and very narrow umbilicus. There are  $4\frac{1}{2}$  convex, gradually increasing whorls, the first  $1\frac{1}{2}$  smooth, remainder sculptured with strong, curved, oblique costulae, which are farther apart on the 2nd than on the succeeding whorls; the intervening striolae are extremely faint and are crossed, at least on the last whorl, by weak microscopic spiral lines.

Diam. maj. (topotype) 5·2, min. 4·6; alt. 3·5; apert. alt. 2·5, lat. 2·4 mm.

Hab. CAPE PROVINCE. Grahamstown (type, Farquhar); Alicedale (Cruden).

Type in British Museum.

# Trachycystis turmalis (Morel.).

Ref. List No. 280.

1889. Helix turmalis Morel., J. de C., xxxvii, p. 5, pl. i, f. 1. D.F.

Another small species with an obtusely conical spire and moderately broad, though not open, umbilicus. It has 5 convex, gradually increasing whorls, covered, after the first 1½, with rather close, curved, oblique, slightly irregular transverse striae, crossed by very close, fine, microspiral grooves; suture deep.

Diam. maj. 5·0, min. 4·6; alt. 3·6; apert. alt. 2·3, lat. 2·1 mm.

Hab. CAPE PROVINCE. Coerney, Port Elizabeth (type, Crawford); Cradock (Farquhar).

Type in British Museum.

Shell described from Cradock, in my collection.

# Trachycystis epetrima (M. & P.).

Ref. List No. 242.

1892. Helix (Pella) epetrima M. & P., A.M.N.H., ix, p. 84, pl. iv, f. 3. D.F.

1932. Trachycystis epetrima M. & P., Conn., Ann. Natal Mus., vii, p. 96, pl. v, f. 4. N.F.

Identical with turmalis in all respects except that the spire may be a little lower, the suture more impressed, and the transverse sculpture a trifle sharper, possibly due to fresher condition. I have seen seven specimens, none of which are quite as large as the type set of turmalis. M. & P.'s type measures

Diam. maj. 4.4, min. 4.1; alt. 2.5; apert. alt. 2.3, lat. 2.1 mm.

Hab. CAPE PROVINCE. Somerset East District (type fide M. & P.); North End, Port Elizabeth (Crawford); Jansenville (Reeve); Zwartberg Pass, Prince Albert District (Barnard).

Type in British Museum.

It is probable that examination of more complete material will establish absolute synonymy between these two species. Zwartberg shells differ from type in rather stronger basal sculpture, greater altitude and wider perforation, but not sufficiently so in either respect as to merit a varietal name.

# Trachycystis aulacophora (Ancey).

Ref. List No. 231.

1890. Helix aulacophora Ancey, Bull. Soc. Mal. France, vii, p. 158. D.

1934. Trachycystis aulacophora Ancey, Watson, Proc. Mal. Soc., xxi, p. 171, pl. xx, f. 22-23. D.N.A.R.

Also a small species with conical spire and very narrow umbilicus. There are 5 whorls, moderately convex, regularly increasing, the first  $1\frac{1}{2}$  smooth, after which the scuplture is of the same nature as in spissicosta, but the costulae, while always closer than in that species, are more distant on the early whorls and become gradually closer on each succeeding one; the intervening striolae, 4 to 6 in number, are very faint and the suture deep.

Diam. maj. 4.5, min. 4.3; alt. 3.6; apert. alt. 2.3, lat. 2.1 mm.

Hab. CAPE PROVINCE. Port Elizabeth to Zwartkops River (type, Crawford); Grahamstown (Kincaid).

Type formerly in coll. Geret.

Description from paratype in my collection.

#### Trachycystis sericea Conn.

1922. Trachycystis sericea Conn., A.M.N.H., x, p. 116. D.
1925. ,, ,, Trans. R. Soc. S. Africa, xii, p. 141, pl. iv, f. 10. D.F.

A small, dark reddish shell, with moderately exserted spire and narrow umbilicus. 5 rounded whorls, the apical smooth, remainder sculptured after the pattern of *spissicosta*, but the costulae, as would be expected in so small a shell, are weaker and closer; upper margin of columella narrowly reflexed, but not obscuring the umbilicus.

Diam. maj. 3.9, min. 3.5; alt. 3.2; apert. alt. 2.1, lat. 1.7 mm.

Hab. LORENZO MARQUES. District 16 miles north of Macequece (type, Cressy).

S. RHODESIA. 6 miles from Penhalonga, 6000 feet (Miss Grey). Type in British Museum.

# Trachycystis connollyi M. & P. Ref. List No. 239.

1909. Trachycystis connollyi M. & P., A.M.N.H., iv, p. 491, pl. viii, f. 15. D.F.

A small shell of chocolate hue, with exserted, conical spire and moderately wide umbilicus. 4 convex, rather rapidly increasing whorls, first  $1\frac{1}{4}$  smooth, remainder covered all over with regular, curved, oblique, rather weak costulae, close together for half a whorl and somewhat distant on the rest, the interstices filled with fine parallel striolae and the whole cut into minute granules by exceedingly fine and close microscopic spiral lines; suture simple, well defined. Aperture nearly circular, labrum nearly straight and receding very gently in profile, columella erect, concave, margin triangularly reflexed, half obscuring the umbilicus.

Diam. maj. 4.8, min. 4.0; alt. 4.0; apert. alt. 2.7, lat. 2.5 mm.

Hab. CAPE PROVINCE. Montagu (type, Connolly); Kuruman (coll. Layard); Elim Road, Bredasdorp; Gorge of Salt R., Windhoek, Bredasdorp Dist. (Rennie).

Type in British Museum.

Description from paratype in my collection.

Rennie's series are considerably better grown than those from Montagu.

## Trachycystis farquhari (M. & P.). Ref. List No. 244.

1892. Helix farquhari M. & P., A.M.N.H., x, p. 240, pl. xiii, f. 9. D.F.

Paler in colour, almost olivaceous, with finer striae than connollyi, and easily distinguished by the umbilicus, which is quite open in that species but more than half concealed in farquhari by the columellar reflexion. My largest example from Montagu, with 4 convex whorls, measures

Diam. maj. 5.0, min. 4.7; alt. 5.0 mm.

Hab. CAPE PROVINCE. Port Elizabeth (type, Farquhar); Montagu (Connolly).

Type in British Museum.

#### Trachycystis planissima Conn.

1925. Trachycystis planissima Conn., A.M.N.H., xv, p. 472, pl. xxviii, f. 12. D.F.

Shell very small, nearly flat, widely umbilicate, brownish corneous. Whorls 4, convex, regularly increasing, first  $1\frac{1}{2}$  practically smooth, remainder covered all over with strong, close, curved, oblique transverse costulae, gradually increasing in distance apart, the intervals between them on the later whorls filled with from 2 to 4 microscopic striolae; suture simple, deep. Aperture nearly circular, labrum receding a little in profile to the base, columella erect, margin scarcely reflexed, umbilicus wide and deep, exposing all the whorls.

Diam. maj. 3.0, min. 2.7; alt. 1.5; apert. alt. 1.0, lat. 1.0 mm.

Hab. CAPE PROVINCE. Verkeerde Vlei, Carnarvon District (M. F. Day).

Type in British Museum.

A small flat shell, with very convex whorls and strong, close costulation.

# Trachycystis petrobia (Bs.).

Ref. List No. 264.

1851. Helix petrobia Bs., A.M.N.H., vii, p. 105. D.

1853. ,, ,, Rve., Conch. Icon., pl. clxxiii, f. 1169. D.F.

1854. *Helix petrobia* Bs., Pfr., Conch. Cab., p. 382, pl. cxli (1852), f. 25–27. *D.F.* 

No authentic example of H. petrobia can be traced, as the set from the Macandrew collection in Cambridge Museum, doubtfully attributed thereto, differs so widely from Benson's description transcribed below that they cannot possibly represent it. Benson wrote:

"Shell umbilicate, depressed, pale corneous, diaphanous, very little glossy, obliquely plicate on both sides with subdistant, unequal plicae, the interstices, under a lens, sharply longitudinally striate. Spire scarcely elevated, suture lightly impressed, whorls  $4\frac{1}{2}$ –5, moderately convex above, slowly increasing, the last obtusely angulate above, more convex beneath, angulately compressed round the umbilicus. Aperture compressed lunate, more high than wide, subangulate below, oblique; peristome simple, acute, right margin arcuate above, columellar margin thin, vertical, narrowly reflexed.

"Diam. maj. 5½, min. 4½, axis 3 mm.

"More widely umbilicate than *perplicata*, with equally oblique plicae, but differing altogether from it and the other described South African species in form, ratio of the whorls, and in the configuration of the aperture."

"I got a single specimen alive . . . under a stone at the side of the road leading from High Constantia towards the gorge by which access is gained to Hout Bay

valley."

#### Hab. CAPE PENINSULA. Near High Constantia (Benson).

Reeve's figure of the probable type depicts a brown shell with flattish spire, body whorl *slightly* shouldered at periphery, and nearly horizontal aperture; "rather narrowly but deeply umbilicate, fulvous brown, olive beneath, densely, finely costulate throughout"; it measures: diam. maj. 13·1, alt. 7·9, apert. alt. 6·2, lat. 5·8 mm.

Pfeiffer's figure is higher spired, with more descending aperture and no shouldering; it measures: diam. 10·1, alt. 7·6, apert. alt. 4·9, lat. 4·9 mm., and may well represent a different species.

Benson's description makes no mention of spiral sculpture on the protoconch and Reeve's figure suggests affinity with the present group, where I place it provisionally rather than hazard a guess by attributing it to one of the groups with more complicated apical sculpture.

The shells in Cambridge Museum, from an unknown locality, are closely allied to *jucunda*, which is, however, an altogether larger form, with far stronger spiral sculpture on the later whorls and base, on which it forms a perfect open network with the transverse costulae.

# Trachycystis metallakter Conn.

Ref. List No. 256.

1912. Trachycystis metallakter Conn., Ann. S.A. Mus., xi, p. 140, pl. ii, f. 6. D.F.

A small species with moderately exserted spire and rather open umbilicus. It has 4½ convex, gradually increasing whorls, the 1st smooth, remainder sculptured

with strong, slightly curved and oblique costae, which are prolonged at the periphery into short, narrow vertical flanges, but become closer and weaker towards the end of the 4th whorl, and more so on any succeeding ones; the intervals are filled with extremely faint, parallel microscopic striolae, cut by stronger, close, regular, spiral lines; suture impressed. Aperture descending slightly, umbilicus not very wide, but deep, extending to the apex, columella weak, margin slightly reflexed, but in no way concealing the umbilicus.

Diam. maj. (type) 4·0, min. 3·4; alt. 2·2; apert. alt. 1·9, lat. 1·5 mm.

Hab. CAPE PROVINCE. Caledon (Muriel Connolly).

Type in British Museum.

The locality in which this striking species was discovered in 1910 has now been obliterated by cultivation, and recent attempts have failed to rediscover it in the neighbourhood.

By reason of its narrow peripheral flanges, metallakter stands on the outer edge of the present group, and leads smoothly into the next.

### (v) Group of sabuletorum Bs.

This is a little group which probably comprises four western species, sabuletorum and rariplicata Bs., the new gemmascabra Conn. and a race from Steinkopf, Little Namaqualand, which appears to be distinct from sabuletorum, but of which material to hand does not justify definite determination.

The radula of three of these species has been examined and Watson informs me that it is of the type found in *Phaulocystis* and in *T. soror* Conn., etc.; and while the genital organs, especially of *T. gemmas-cabra*, seem to resemble those of the former group, the shell is perhaps more like that of the latter. I therefore place the present group between these two. The only sub-genus also found near the west coast that it approaches anatomically is *Xerocystis*, from which it can be easily separated by its shell.

## Trachycystis sabuletorum (Bs.). Ref. List No. 272.

1851. Helix sabuletorum Bs., A.M.N.H., vii, p. 105. D.

Shell small, depressed globose, thin, asperate, translucent, early whorls in fresh condition pale corneous brown, later whitish and semi-opaque. Spire little raised, apex very small. Whorls 5½, convex, rounded at periphery, regularly increasing, apical microscopically malleate, remainder sculptured with strong, curved, oblique transverse costae, gradually increasing in distance apart, almost developing flanges at the periphery and continuing on the base, the interstices crowded with fine parallel striae; suture simple, well defined. Aperture ¾-lunar, columella short, concave, margin practically unreflexed, umbilicus wide and open, exposing all the whorls. The topotype described measures

Diam. maj. 4·3, min. 4·0; alt. 2·5; apert. alt. 1·8, lat. 1·8 mm.

Hab. CAPE PENINSULA. Hout Bay (type, Benson); generally distributed along the coast.

CAPE PROVINCE. Stumpnose (Gould); Hermanus (Lightfoot). Originals in Cambridge Museum.

## Trachycystis rariplicata (Pfr.). Ref. List No. 269.

1849. Helix rariplicata Bs., Pfr., Zeitschr. f. Mal., vi, p. 71. D. 1853. ,, ,, ,, Rve., Conch. Icon., pl. clxxiv, f. 1183. D.F.

Differs from the foregoing in having a slightly more exserted spire and more corneous texture; there are 5 whorls, sculptured as in *sabuletorum*, but the costae rather weaker and closer; the columellar margin is extremely narrowly reflexed, the umbilicus slightly less open and does not expose all earliest whorls.

Diam. maj. 4.2, min. 3.8; alt. 3.1; apert. alt. 1.8, lat. 1.8 mm.

Hab. CAPE PENINSULA. Green Point Lighthouse (Benson). Type in Stettin Museum.

Shell described ex coll. Cuming in British Museum.

Although specimens of *sabuletorum* have been frequently distributed under the name of this species, and have probably caused erroneous impressions as to both shell and radula, I have not been able to trace any actual instance of its rediscovery since first gathered by Benson, and it has probably been extinguished by the march of civilization.

# Trachycystis gemmascabra sp. n. (Text-fig. 17A.)

Shell very small, depressed globose, umbilicate, asperate, pale corneous brown. Spire not much raised, though each whorl is raised well above the next. Whorls 4,







Text-fig. 17a.— $Trachycystis\ gemmascabra$  Conn., Aiais,  $\times$  8, and portion of sculpture, highly magnified.

convex, rounded at the periphery, gradually increasing, first  $1\frac{3}{4}$  smooth and glossy, remainder sculptured all over into the umbilicus with curved oblique costae, close

and weak at first and increasing regularly in strength and distance apart, the interstices filled with very close and fine microscopic parallel striolae. Aperture  $\frac{7}{8}$  lunar, peristome simple, columella short and concave, margin unreflexed and not approaching the umbilicus, which is deep and comparatively wide, exposing all the whorls.

Diam. maj. 2.5, min. 2.1; alt. 1.3 mm.

Hab. GREAT NAMAQUALAND. Aiais (Hesse and Thorne). Type in South African Museum.

### (vi) Group of laticostata M. & P.

Very small, flattish corneous shells, with very strong, rather distant costate sculpture.

Trachycystis laticostata M. & P.

Ref. List No. 251.

1903. Trachycystis laticostata M. & P., A.M.N.H., xii, p. 602, pl. xxxii, f. 5. D.F.

Shell very small, depressed, umbilicate, thin, asperate, transparent, corneous yellow-brown. Spire depressed conic, apex mamillate. Whorls  $4\frac{1}{2}$ , convex, regularly increasing, narrowly rounded at the periphery, first  $1\frac{1}{2}$  engraved with close, microscopic spiral lines, remainder bearing strong, rather distant, curved oblique laminae, developing a flange at the periphery, the intervals filled with from 3 to 4 close, faint, parallel striolae and the whole cut by very close microscopic spiral lines. Aperture nearly circular, peristome simple, acute, labrum slightly curved and receding in profile, columella concave, margin scarcely at all reflexed, umbilicus wide, deep, and open.

Diam. maj. (type) 4.2, min. 3.5; alt. 2.0; apert. alt. 1.7, lat. 1.4 mm.

Hab. CAPE PROVINCE. Maestrom Forest, Bedford (type); Grahamstown (Farquhar); Deep Walls and Harkerville, Knysna District; Zonder Einde, Caledon (Mrs. Longstaff); Dixon's Bush; Martindale (Kincaid); Hogs Back, Amatola Mts. (Smith).

Type in British Museum.

# Trachycystis rudicostata Conn.

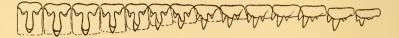
(Text-fig. 18.)

1922. Trachycystis rudicostata Conn., A.M.N.H., x, p. 117. D. 1925. ,, ,, Trans. R. Soc. S. Africa, xii, p. 143. D.F.A.R.

Shell very small, with exserted spire;  $3\frac{3}{4}$  very convex, rounded, regularly increasing whorls, the protoconch,  $1\frac{1}{2}$  whorls, closely covered with microscopic spiral striolae, remainder bearing very strong, prominent, slightly curved and oblique transverse lirae, increasing regularly in distance and developing into strong flanges for more than half their length, the intervals filled with close, fine, parallel striolae and no spiral sculpture; suture simple, much impressed. Aperture nearly circular, without columellar reflexion.

Diam. maj. 1.8, min. 1.6; alt. ca. 0.9 mm.

Hab. NATAL. Dargle (type); Inhluzani Mountain; Nottingham Road; Howick; Hilton Road; Edendale; Pietermaritzburg;



Text-fig. 18.—Trachycystis rudicostata Conn., Ntimbankulu. Half row of teeth of radula; ×1200.

Ntimbankulu Hill, Mid-Illovo District; Van Reenen's Pass, Drakensberg (Burnup); Majuba (Connolly).

LORENZO MARQUES. Mt. Vengo (Cressy).

Type in British Museum.

The shell is comparatively higher than *laticostata* and does not attain the same size; the ends of the peristome are nearer together and there is no spiral sculpture on the later whorls.

## Trachycystis liricostata (M. & P.). Ref. List No. 253.

1891. Helix (Pella) liricostata M. & P., A.M.N.H., viii, p. 239. D. 1892. ,, ,, ,, ix, p. 94, pl. v, f. 1. F.

Smaller than *laticostata*, widely umbilicate, with  $4\frac{1}{4}$  convex, rounded whorls, protoconch,  $1\frac{1}{2}$  whorl, smooth, remainder covered all over into the umbilicus with slightly curved and oblique, somewhat distant transverse costae, the intervals filled with close, regular, slightly undulating spiral grooves; suture simple, canaliculate. Aperture more than  $\frac{3}{4}$ -lunar, columella weak, concave, margin scarcely reflexed, not approaching the wide, deep umbilicus.

Diam. maj. 2.8, min. 2.5; alt. 2.5 mm.

Hab. CAPE PROVINCE. East Griqualand (type, fide M. & P.); Maclear (coll. Wotton); Van Staaden's River and Coerney, Port Elizabeth (Crawford).

Type in British Museum.

A beautiful little shell, with the costae much closer than in *lati-costata* and not prolonged into flanges at the periphery.

# Trachycystis rutilans M. & P. Ref. List No. 271.

1908. Trachycystis rutilans M. & P., A.M.N.H., i, p. 135, pl. vii, f. 9. D.F.

Differs from the three foregoing through the transverse costae being a little closer and less strong, not forming peripheral lamellae; there is no spiral sculpture

on the protoconch, but it is present, cutting the very faint interspersed intermediate striolae, on the later whorls; there are  $3\frac{1}{2}$  whorls, the dimensions being Diam. maj. 2·35, min. 2·15; alt. 1·2 mm.

Hab. NATAL. Pietermaritzburg (Burnup). Type in British Museum.

# Trachycystis soror Conn. (Pl. ix, f. 5-6.)

1922. Trachycystis soror Conn., A.M.N.H., x, p. 118. D. 1925. ,, ,, Trans. R. Soc. S. Africa, xii, p. 145, pl. iv, f. 14. N.F.A.R.

A minute species, which might at first sight be mistaken for rudicostata, but is easily distinguished under a microscope through its apical sculpture being devoid of spiral striation. It has  $3\frac{1}{2}$  rounded, regularly increasing whorls, first half indistinctly micropunctate, next showing rather distant radial striae, which strengthen on those succeeding it into transverse lamellae, of which there are about 20, from 0.12 to 0.15 mm. apart, on the last whorl, interspersed with rather fine, irregular, microscopic transverse, crossed by equally fine spiral, striolae; umbilicus rather wide, extending to the summit and exposing all the whorls.

Diam. maj. 1.5, min. 1.3; alt. ca. 0.8 mm.

Hab. LORENZO MARQUES. Mt. Vengo, 5500 feet (Cressy). Type in British Museum.

T. soror is also nearly allied to rutilans, of which it may be a dwarf race; the costae, however, are noticeably further apart than in rutilans at the same stage of development and the last whorl more descending, features that appear to afford ground for separation.

The radula formula is about  $(5+5+1+5+5) \times 80$ ; centrals and laterals tricuspid, marginals with long mesocones and endocones, ectocones dividing into 2 or even 3 small cusps.

## (vii) Group of ordinaria M. & P.

Another group of very small shells, which may be taken as dependent on that of *simplex*, but branching off earlier than the last, near *aulacophora* Ancey, and placed together for convenience on account of their smaller size. As the best known member, I base the group on

# Trachycystis ordinaria M. & P. Ref. List No. 259.

1908. Trachycystis ordinaria M. & P., A.M.N.H., i, p. 135, pl. vii, f. 8. D.F.

Shell small, depressed globose, umbilicate, silky, reddish corneous brown. Spire only moderately exserted, apex blunt. Whorls 5, convex, gradually in-

creasing, first  $1\frac{1}{4}$  smooth, remainder covered all over with strong, close, regular, slightly curved and oblique transverse costulae, with extremely faint parallel striolae in the interstices, and, under 20-fold magnification in a good light, traces of extremely close, faint, microspiral lines; suture simple, well defined. Aperture  $\frac{3}{4}$ -lunar, labrum receding gently in profile, columellar margin scarcely reflexed, leaving open the deep, moderately wide umbilicus.

Diam. maj. 3.75, min. 3.3; alt. 2.2; apert. alt. 1.6, lat. 1.3 mm.

Hab. TRANSVAAL. Potchefstroom (type, Miss Livingston; Connolly).

O.F.S. Bloemfontein (Connolly); Kroonstad (Miss Hickey).

Type in British Museum.

Description from a topotype in my collection.

Some confusion has arisen through this species having been founded on an immature shell only 2.8 mm. in major diameter, thereby spreading the impression that it is much smaller than is actually the case.

# Trachycystis somersetensis (M. & P.). Ref. List No. 275.

1893. Helix (Patula) somersetensis M. & P., A.M.N.H., xi, p. 19, pl. iii, f. 2. D.F.

The unique type pair comprises two very small bleached weatherworn shells, resembling ordinaria in form, but with weaker and perhaps slightly more distant costulate sculpture. There are 4 convex, slowly increasing whorls, rounded at the periphery; the columellar margin is unreflexed and the umbilicus wide and open. Diam. maj. (type) 2·8, min. 2·5; alt. ca. 1·8 mm.

Hab. CAPE PROVINCE. Somerset East (Miss Bowker). Type in British Museum.

Trachycystis rivularis (Krs.).
(Pl. ix, f. 11–12.)
Ref. List No. 270.

1848. Helix rivularis Krs., Südafr. Moll., p. 77, pl. iv, f. 25. D.F.

Shell small, depressed globose, perforate, thin, silky, bright corneous brown. Spire not much raised. Whorls  $4\frac{1}{4}$ , rounded, gradually increasing, covered on both sides, after the apical, with close, prominent, regular, curved transverse costulae, microscopic transverse and spiral sculpture as in *ordinaria*; suture impressed. Aperture lunate, descending a little in front, peristome simple, columella weak, concave, margin slightly reflexed, but in no way covering the umbilicus, which, though not wide, is deep, extending to the apex.

Diam. maj. 2.33; alt. 1.4 mm.

Hab. NATAL. Source of Mooi River (Wahlberg). Type in Stockholm Museum.

I have never been able to match the unique type of this little species, which has extremely slightly wider costulation than the following variety and others of its group.

var. densestriata Conn. (Pl. ix, f. 13-14.) Ref. List No. 270.

1912. Trachycystis rivularis Krs., var. densestriata Conn., Ann. S.A. Mus., xi, p. 145. D.F.

Differs from foregoing only in the costulae being infinitesimally, though manifestly, closer together; the spire also, in the photographs here reproduced, is slightly more depressed, but this may not prove a constant point of difference when further examples of the typical form become available for comparison. The varietal type has  $4\frac{1}{2}$  whorls, and measures

Diam. maj. 3.2, min. 3.0; alt. 2.1 mm.

Hab. TRANSVAAL. Zwart Kop, Pretoria (type); Buiskop; Pietersburg (Connolly).

Type in British Museum.

The line of demarcation between certain local races referable to ordinaria, rivularis, and var. densestriata is so vague as to be almost undefinable, and all these forms may perhaps be merely subvarieties of a single species, with its headquarters in the Northern Transvaal, where it predominates, but there is no difficulty in separating those from the actual type-localities.

### Trachycystis persimilis Conn.

1932. Trachycystis persimilis Conn., Ann. Natal Mus., vii, p. 97, pl. v, f. 4. D.F.

Possibly representing a south-eastern race of rivularis, but differing constantly from both the typical and varietal forms in having very slightly closer, weaker, and less oblique sculpture. The colour is yellowish or reddish brown; spire nearly flat; 5 convex whorls, first  $1\frac{1}{2}$  white, micromalleate, remainder covered with strong, slightly curved and oblique transverse costae, increasing regularly in distance apart, the intervals closely packed with extremely fine, parallel, microscopic striolae, crossed by equally close and fine spiral lines; suture canaliculate. Aperture  $\frac{3}{4}$ -lunar, labrum scarcely receding in profile, columella concave, inclined to left, extreme upper margin very slightly reflexed, umbilicus wide and openly tubular.

Diam. maj. 3.6, min. 3.1; alt. 2.4; apert. alt. 1.9, lat. 1.7 mm.

Hab. ZULULAND. Mfongosi (type, Jones).

NATAL. Sand Spruit (Burnup); Weenen (Thomasset).

Type in British Museum.

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#### (viii) Group of bathycoele M. & P.

Very small flattened shells with more or less strongly costulate sculpture, closely resembling the Australasian genus *Charopa*.

Trachycystis bathycoele (M. & P.). Ref. List No. 232.

1892. *Helix* (*Pella*) bathycoele M. & P., A.M.N.H., ix, p. 89, pl. v, f. 4. D.F.

Shell very small, depressed orbicular, umbilicate, thin, asperate, semi-transparent, corneous yellow-brown. Spire almost flat. Whorls  $5\frac{3}{4}$ , convex, rounded at the periphery, slowly increasing, first  $1\frac{3}{4}$  smooth in the type, remainder covered all over with strong, straight, close, regular, transverse costae, gradually increasing in distance apart, the intervals filled with from 4 to 7 fine, close, parallel microscopic striolae; suture simple, deep. Aperture  $\frac{3}{4}$ -lunar, peristome simple, acute, labrum straight and vertical in profile, columella very short, weak and unreflexed, umbilicus deep and open, exposing all the whorls.

Diam. maj. (type) 3.0, min. 2.7; alt. ca. 2.0 mm.

Hab. CAPE PROVINCE. Craigie Burn, Somerset East (type, Miss Bowker); Bedford; Grahamstown (Farquhar); Shoemakers Kop, Port Elizabeth (Smith).

NATAL. Pietermaritzburg; Ntimbankulu (Burnup); Winkle Spruit (Akerman).

Type in British Museum.

Some series examined differ from the type pair in being costate to the extreme apex, but I can find no other point of variance whatever between them.

Trachycystis fossula Conn.

1925. Trachycystis fossula Conn., Trans. R. Soc. S. Africa, xii, p. 142, pl. iv, f. 12. D.F.

Extremely close to the foregoing. The unique type was unfortunately badly damaged during illustration, but the whorls appear to increase a trifle less slowly and the costae to be a little weaker than in M. & P.'s species.

Diam. maj. (type) 3·3, min. 3·0; alt. 2·0 mm.

Hab. LORENZO MARQUES. Mt. Vengo, 5500 feet (Cressy). Type in British Museum.

Trachycystis patera M. & P. Ref. List No. 261.

1903. Trachycystis patera M. & P., A.M.N.H., xii, p. 603, pl. xxxii, f. 6. D.F.

While resembling bathycoele in many respects, patera has a perfectly flat spire;  $5\frac{3}{4}$  very convex whorls, first  $1\frac{1}{2}$  smooth, remainder covered all over with very

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close, regular, curved, slightly oblique transverse striae; umbilicus very wide, exposing all the whorls.

Diam. maj. (type) 2.7, min. 2.5; alt. 1.1 mm.

Hab. CAPE PROVINCE. Maeström Forest, Bedford (type, Farquhar); Caledon (Mrs. Longstaff).

CAPE PENINSULA. Simonstown (Connolly).

Type in British Museum.

## Trachycystis bifoveata Conn.

1932. Trachycystis bifoveata Conn., Ann. Natal Mus., vii, p. 103, pl. v, f. 13. D.F.

Shell very small, discoid, perforate, thin, asperate, pale corneous brown. Spire and apex impressed. Whorls 5¼, very gradually increasing, convex, strongly shouldered at the suture, the 1st glossy, showing only faint microscopic radial striolae, remainder sculptured with strong, fine costae, curved forward to the periphery and then receding, the interstices filled with close, fine, parallel striolae, from 4 to 6 between the costae on the later whorls; suture simple, deeply impressed. Aperture semilunar, peristome simple, acute, labrum conforming to the costulation, columella short and concave, margin simple, umbilicus rather wide, extending to the summit and clearly exposing all the whorls.

Diam. maj. 3.0, min. 2.4; alt. 1.3; apert. alt. 1.3, lat. 0.75 mm.

Hab. NATAL. Game Pass (Burnup).

Type in British Museum.

The strong costulation and forward angulation of the labrum render this beautiful little species easily recognisable.

#### Trachycystis contabulata Conn.

1932. Trachycystis contabulata Conn., Ann. Natal Mus., vii, p. 103, pl. v, f. 8. D.F.

Shell very small, discoid, perforate, thin, silky, pale corneous. Spire flat. Whorls 5, very gradually increasing, convex, slightly shouldered at the suture, the 1st sculptured with extremely faint microscopic radial striolae, remainder covered with very close, fine, strong, nearly straight transverse costulae; suture canaliculate. Aperture \(^3\_4\)-lunar, peristome simple, labrum straight and vertical in profile, columella inclined to the left, margin simple, umbilicus moderately wide, extending to the summit and exposing all the whorls.

Diam. maj. 2·4, min. 2·1; alt. 1·25; apert. alt. 1·25, lat. 0·7 mm.

Hab. NATAL. Game Pass (type, Burnup); Nottingham Road; Curry's Post (Taynton).

Type in British Museum.

### Trachycystis felina Conn.

1932. Trachycystis felina Conn., Ann. Natal Mus., vii, p. 103, pl. v, f. 11. D.F.

Shell very small, depressed orbicular, perforate, thin, silky, corneous brown. Spire flat. Whorls 5, convex, regularly increasing, protoconch,  $1\frac{1}{2}$  whorl, smooth and glossy, remainder sculptured all over with extremely fine and close, straight transverse striae, which are just visible under a hand-lens; suture canaliculate. Aperture  $\frac{3}{4}$ -lunar, not receding at base, peristome simple, columella very short, upper margin scarcely reflexed, umbilicus rather wide, extending to the summit and exposing all the whorls.

Diam. maj. 3.6, min. 3.2; alt. 2.2 mm.

Hab. CAPE PROVINCE. Katherg Forest (Hewitt).

Type in Albany Museum.

Larger than the two foregoing species, with finer, closer striation than bathycoele, patera, or fossula.

(ix) Group of inclara Morel.
Sub-genus Psichion Gude, 1911
(Proc. Mal. Soc., ix, p. 272).
Type Helix miliaris Morel.

Hinder part of foot rounded above, not keeled; duct of spermatheca considerably enlarged towards anterior end; epiphallus moderately long, entering the side of the broadly fusiform penis at some distance from its hinder end, to which the penial retractor is attached.

Radula specialised: Central and lateral teeth rather narrow, latter more numerous than in other known sub-genera of *Trachycystis*; anterior half of basal part of mesocone absent from these teeth, so that the mesocone arises from towards the posterior end of the basal plate and is thus widely separated from the small ectocones and endocones, which arise from close to front edge of tooth, while between these in the laterals 1 or 2 minute denticles occur; cusps of marginals less closely united basally than in other sub-genera, mesocone pointed, endocone in certain species divided into 2 very slender cusps in some of the teeth, and ectocone always divided into from 2 to 5 small denticles.

An uninteresting group of small, subconical shells of dull aspect and weak sculpture, with a tendency towards faint lilac or roseate grey coloration.

## Trachycystis inclara (Morel.). Ref. List Nos. 240 and 249.

1889. Helix inops Morel., J. de C., xxxvii, p. 6, pl. i, f. 2. D.F.

1889. , inclara (=inops Morel., 1889, non Mouss., 1872),Morel., ibid., p. 200. (Emend. nom.)

1889. Helix bowkeriana Ancey, in litt.

1912. Trachycystis coxi Prest., Proc. Mal. Soc., x, p. 18. D.F.

inclara Morel., Watson, Proc. Mal. Soc., xxi, p. 173, pl. xx, f. 25. A.R.

Shell small, subglobose, most narrowly umbilicate, dull, slightly silky, semitransparent, corneous buff. Spire subconical, sides straight, apex narrowly rounded. Whorls 5, moderately convex, rounded at the periphery, regularly increasing, first 2 practically smooth, remainder sculptured with weak, slightly curved and oblique striae or growth lines, crossed on the base by excessively fine, close, microscopic spiral lines; suture simple, well defined. Aperture 3-lunate, labrum slightly flexuous and receding little in profile, peristome simple, acute, columella short, straight, erect, margin triangularly reflexed, almost obscuring the minute umbilicus.

Diam. maj. (type) 5.2, min. 4.7; alt. 4.1; apert. alt. 2.7, lat. 2.7 mm.

Hab. CAPE PROVINCE. Port Elizabeth (type, Crawford); Grahamstown (bowkeriana, Miss Glanville): Knysna Forest (coxi, Cox); Keurbooms R. bush (Barnard); distributed about the foregoing districts as far east as Port St. John's (Shortridge).

Types of inclara and coxi in British Museum.

When I wrote my Reference List it seemed possible that coxi might be differentiated from inclara owing to its shell texture being a trifle clearer, but comparison with a large series of inclara, recently to hand, proves that the shell of this species, albeit liable to become dull and clouded under very slight weathering, is nearly clear in fresh young specimens, and the fact that the type set of coxi retained this feature at a greater age than usual is probably attributable to the damp forest habitat being favourable to its preservation. Apart from this, coxi and inclara agree in every detail, and Preston's species must be considered entirely synonymous with that of Morelet.

#### Trachycystis shilwaneensis Conn.

1922. Trachycystis shilwaneensis Conn., Proc. Mal. Soc., xv, p. 73, pl. ii, f. 3. D.F.

Not unlike inclara, but with less narrow perforation and stronger spiral sculpture. The subconical shell is pale rufous corneous, with 54 flattish whorls, rounded at the periphery, first 1½ practically smooth, remainder covered all over with very close, faint, transverse, crossed by finer, equally close, microscopic spiral striae; columella weak, margin narrowly reflexed, half-concealing the narrow umbilicus.

Diam. maj. (type) 5.7, min. 5.0; alt. 4.2; apert. alt. 2.7, lat. 2.7 mm.

Hab. TRANSVAAL. Mt. Manotsuri, Shiluwane District (type, Junod).

NATAL. Mont aux Sources (var., Falcon).

Type in Kimberley Museum.

The largest example seen measures  $6\cdot 2\times 5\cdot 2$  mm. in diameter and  $4\cdot 5$  in height.

The Basuto set differs from type in weaker sculpture, especially radial, less exserted spire, more convex whorls, deeper suture, and less open umbilicus. They may well be a distinct species, but their condition hardly admits of exact differentiation.

### Trachycystis junodi Conn.

1922. Trachycystis junodi Conn., Proc. Mal. Soc., xv, p. 73, pl. ii, f. 1. D.F.

The largest of the group, subglobose, narrowly rimate, corneous greenish brown. 5 convex, rounded whorls, the 1st smooth, remainder covered all over with close, regular, curved transverse, crossed by equally fine spiral striae; columella very weak, margin narrowly reflexed, but almost concealing the narrow, deep rima.

Diam. maj. 8·3, min. 7·1; alt. 5·5; apert. alt. 5·0, lat. 4·2 mm.

Hab. TRANSVAAL. Mt. Manotsuri, Shiluwane District (type, Junod).

NATAL. Karkloof (Burnup).

Type in Kimberley Museum.

Watson (l.c., p. 173) writes of the Karkloof race as "an apparently unnamed species," but Burnup and myself were unable to detect any satisfactory grounds for its separation from that now under notice.\*

# $Trachycystis\ microstriata\ {\tt Prest.}$

Ref. List No. 258.

1912. Trachycystis microstriata Prest., Proc. Mal. Soc., x, p. 18. D.F.

A small shell, closely resembling *inclara* in form, but differing in sculpture, which is absent from the first  $1\frac{1}{4}$  whorl and then consists of exceedingly close, fine, slightly curved and oblique microscopic transverse striolae, gradually gaining

<sup>\*</sup> I would explain here that in this, and any other instances in which I may not follow completely the views expressed in Watson's recent paper, it is without the slightest prejudice as to the probable correctness of his determination.

in strength and about every 7th a little stronger than those between, and equally close, fine, microscopic spiral lines, which cut the transverse sculpture and impart to the surface a beautifully regular microscopic granulation. The shell is corneous yellow-brown and contains  $4\frac{1}{2}$  whorls. Preston's measurements of the type are

Diam. maj. 4.5, min. 4.0; alt. 3.0; apert. alt. 2.5, lat. 1.75 mm.

Hab. CAPE PROVINCE. Knysna (Cox).

Type in coll. Dautzenberg.

#### Trachycystis ambigua Conn.

1922. Trachycystis ambigua Conn., A.M.N.H., x, p. 116. D. 1925. ,, ,, Trans. R. Soc. S. Africa, xii, p. 141, pl. iv, f. 9. N.F.

Differs from *shilwaneensis*, its nearest ally, in having a very slightly lower spire and narrower whorls, in the spiral striae being a little weaker above and farther apart on the base, and in being almost imperforate. The carneo-corneous shell contains 5 rounded, rapidly increasing whorls, the apical smooth, remainder covered on both sides with extremely close, straight, microscopic transverse striae, with spiral lines first visible about the 4th, and cutting the transverse sculpture on the 5th whorl. Columella very short, margin very narrowly reflexed, but almost covering the minute rima.

Diam. maj. (type) 4.5, min. 4.0; alt. 3.7; apert. alt. 2.5, lat. 2.1 mm.

Hab. LORENZO MARQUES. Headwaters of R. Inyamkarrara, 25 miles N.W. of Macequece (type, Cressy); Lebombo Marsh, Rikatla (Junod).

S. RHODESIA. Vumbu Range, near Umtali, 5700 feet (Arnold). Also recorded from Mt. Chiradzulu, Nyasaland (Johnston). Type in British Museum.

# Trachycystis ectima M. & P.

Ref. List No. 241.

1899. Trachycystis ectima M. & P., A.M.N.H., iv, p. 197, pl. iii, f. 8. D.F.

1934. Trachycystis ectima M. & P., Watson, Proc. Mal. Soc., xxi, pp. 163, 173, pl. xxi, f. 26. N.A.

A small, somewhat globose, creamy corneous shell with minute umbilicus. There are  $4\frac{1}{2}$  convex whorls, bluntly shouldered at the periphery, first  $1\frac{1}{2}$  smooth, remainder sculptured all over with regular, slightly curved and oblique transverse costulae, with about 7 extremely fine, close, parallel microscopic striolae in the intervals, cut by equally fine and close spiral lines, so that the surface is minutely granulate; suture simple, well defined. Aperture sublunate, columella concave, margin narrowly reflexed, almost concealing the very narrow umbilicus.

Diam. maj. (type) 3.6, min. 3.2; alt. 2.5; apert. alt. 2.2, lat. 2.2 mm.

Hab. NATAL. Umkomaas (type); Tongaat (Burnup); Winkle Spruit (Akerman).

Type in British Museum.

The Tongaat race differs from type in the costulæ being very much weaker, little more than rather coarse striae; the largest example I have seen from this locality contains nearly 5 whorls and measures  $4.8 \times 3.3$  mm. in width and height.

### (x) Group of teretiuscula M. & P.

Insignificant little shells with practically smooth apical and finely striate later whorls.

## Trachycystis teretiuscula M. & P.

Ref. List No. 277.

1897. Trachycystis teretiuscula M. & P., A.M.N.H., xix, p. 635, pl. xvii, f. 5. D.F.

1932. Trachycystis teretiuscula M. & P., Conn., Ann. Natal Mus., vii, p. 95. N.

Shell small, depressed globose, umbilicate, thin, smooth, rather dull, pale corneous brown. Spire but little raised, apex obtuse. Whorls 5, gradually increasing, rounded at the periphery and strongly shouldered at the suture, first  $1\frac{1}{2}$  smooth except for slight pitting, remainder covered all over with extremely close and fine, nearly straight, transverse microscopic striae; suture simple, canaliculate. Aperture  $\frac{3}{4}$ -lunar, labrum straight and vertical in profile, columella concave, margin narrowly reflexed, partially overhanging the very narrow umbilicus.

Diam. maj. (type) 4.0, min. 3.7; alt. 3.0; apert. alt. 1.6, lat. 1.6 mm.

Hab. NATAL. Pietermaritzburg (type); Howick; Equeefa; Dargle etc. (Burnup); Majuba (Connolly); Mkolombe Mountains (Thomasset).

ZULULAND (Jones).

O.F.S. Platberg, Harrismith (Connolly).

CAPE PROVINCE. Fern Kloof, Grahamstown (Farquhar); East London (var., Godfrey); Maclear (coll. Wotton).

Type in British Museum.

The Mkolombe shells have a rather more depressed spire and impressed suture than normal, while those from Platberg and Majuba show strong microgranulation, caused by intersection of the transverse striae by spiral grooves as strong as themselves, and may well be specifically distinct.

#### Trachycystis glanvilliana (Ancey).

(Pl. vi. f. 5-7.)

Ref. List No. 245.

1893. Helix glanvilliana Ancey, Bull. Soc. Mal. Fr., vii, p. 157. D.

Very nearly allied to the foregoing; it appears, however, to be a smaller form, with the same number, 5, of whorls; the shouldering at the suture is comparatively sharper and the transverse sculpture usually weaker, while it is cut by microscopic spiral lines, hardly visible on the upper surface, though stronger on the base; the umbilious is extremely small.

Diam. maj. (type) 2.75, min. 2.5; alt. 1.8 mm.

Hab. CAPE PROVINCE. Grahamstown (type, Miss Glanville); Port Alfred (Hewitt); Port Elizabeth (Farquhar); Peddie; East London; Blaauwkrantz; Martindale; Dixon's Bush (Kincaid).

Type in British Museum.

The type is nearly, though not quite, full grown; the species attains slightly greater dimensions.

As this species has never been figured, I select it to illustrate this most uninteresting group.

#### Trachycystis glebaria M. & P. Ref. List No. 246.

1903. Trachycystis glebaria M. & P., A.M.N.H., xii, p. 602, pl. xxxii, f. 15. D.F.

1932. Trachycystis glebaria M. & P., Conn., Ann. Natal Mus., vii, p. 95. N.

Shell small, much depressed globose, umbilicate, thin, silky, transparent, corneous brownish yellow. Spire but little exserted, apex narrowly rounded. Whorls 5, gradually increasing, convex, rounded at the periphery, first 1½ smooth, remainder sculptured all over with extremely close and fine, regular, straight transverse striolae; suture simple, impressed. Aperture 3-lunar, peristome simple, acute, labrum straight and vertical in profile, columella concave, very weak, margin unreflexed, umbilicus narrow, but extending to the summit and just exposing all the whorls.

Diam. maj. (type) 3.6, min. 3.2; alt. 2.2; apert. alt. 1.6, lat. 1.6 mm.

Hab. NATAL. Pinetown (type); Hilton Road (Burnup); Krantzkop (Warren); Equeefa (forma minor, Burnup).

Type in British Museum.

A very ordinary little shell, apparently of some rarity, differing in its texture and yellowish colour from its near allies.

The race from Krantzkop is rather smaller than normal, but otherwise typical.

#### Trachycystis plebeia Conn.

1932. Trachycystis plebeia Conn., Ann. Natal Mus., vii, p. 96, pl. v, f. 1. D.F.

Differs from the foregoing in smaller size, duller surface, brown instead of yellow colour, slightly weaker sculpture and comparatively very slightly wider umbilicus. There are 5 convex whorls, first  $1\frac{1}{2}$  practically smooth, remainder sculptured all over with exceedingly fine and close, straight, regular, microscopic transverse striolae; suture deep. Aperture  $\frac{3}{4}$ -lunar, labrum nearly straight and erect in profile, columella concave, margin practically unreflexed, umbilicus rather wide, openly tubular.

Diam. maj. 3·3, min. 3·0; alt. 1·8 mm.

Hab. NATAL. Bushman's R. Falls (type, Burnup); Weenen (Thomasset).

ZULULAND. Mfongosi (Jones).

Type in British Museum.

Trachycystis falconi sp. n.

(Pl. vi, f. 17-19.)

Shell very small, depressed conoid, umbilicate, thin, transparent, smooth and glossy, pale corneous brown. Spire exserted, sides subgradate, apex rounded. Whorls  $5\frac{1}{2}$ , slowly increasing, convex and rounded, 1st practically smooth, remainder sculptured all over with extremely fine, close, regular, straight radial microscopic striolae; suture well defined. Aperture obliquely lunate, labrum straight and not receding in profile, columella short, concave, margin triangularly reflexed, half obscuring the very narrow umbilicus.

Diam. maj. 3.0, min. 2.8; alt. 2.3 mm.

Hab. CAPE PROVINCE. Port St. John's (Falcon).

Type in British Museum.

The subconoid form distinguishes this little species from others of the genus and suggests affinity with *Sitala* or *Kaliella*, but the straight transverse sculpture, without trace of spiral, proves it to be a *Trachycystis*.

The three species which follow may perhaps best be placed here, though they are much larger than those just treated and may probably belong to two or more distinct sub-genera; all, however, are remarkable for complete mediocrity and lack of distinctive feature, in which they agree with the present group, *subpinguis* leading therefrom towards the larger forms.

Trachycystis subpinguis Conn.

1922. Trachycystis subpinguis Conn., Proc. Mal. Soc., xv, p. 74, pl. ii, f. 2. D.F.

1934. Trachycystis subpinguis Conn., Watson, Proc. Mal. Soc., xxi, pp. 163, 174, pl. xx, f. 24. R.

Shell small, depressed conoid, perforate, thin, smooth, glossy, pale corneous. Spire but little raised, sides straight. Whorls 6, gradually increasing, rounded, bluntly subcarinate on upper portion of periphery, first 1½ faintly micropunctate, remainder sculptured all over with faint, rather distant, nearly straight transverse striae, the intervals filled with close, faint parallel striolae crossed by extremely close and faint wavy microspiral lines; suture well defined. Aperture oblique, lunate, labrum practically straight in profile and hardly receding, columella short, weak, concave, margin shortly and narrowly reflexed, not concealing the minute umbilicus.

Diam. maj. 5.7, min. 5.2; alt. 3.6; apert. alt. 2.6, lat. 3.0 mm.

Hab. NATAL. Pietermaritzburg (type, Connolly; Burnup); Balgowan (Pennington); Karkloof (Taynton).

TRANSVAAL. Mt. Manotsuri, Shiluwane (Junod).

Type in British Museum.

Radula formula  $(20+9+1+9+21) \times 161+n$ ; central and laterals formed somewhat as in Psichion, but lacking the minute denticles between endocones and ectocones.

This species has been widely distributed under the name of Zingis pinguis (Krs.), which is a typical Gudeëlla and bears little resemblance to it. Falcon informs me that he has never found subpinguis except on the bark of trees in wet weather and under it in dry.

## Trachycystis mediocris sp. n. (Pl. vi, f. 11–13.)

Shell of moderate size, depressed globose, umbilicate, thin, dull, slightly silky, transparent, pale chestnut above with occasional pale transverse streaks, and paler beneath. Spire not much exserted, apex obtuse. Whorls  $5\frac{1}{2}$ , moderately convex, rounded at periphery, regularly increasing, first 1½ smooth, remainder sculptured with exceedingly fine, close, nearly straight transverse striolae, of unequal strength, and stronger on the base nearing the labrum, and far finer microspiral lines, only just discernible in good light under 20-fold magnification; suture simple, well defined. Aperture obliquely  $\frac{3}{4}$ -lunar, peristome simple, labrum straight, scarcely receding, columella short, concave, margin triangularly reflexed, half overhanging the narrow umbilicus.

Diam. maj. 7.8, min. 7.2; alt. 5.5; apert. alt. 3.6, lat. 3.6 mm.

Hab. CAPE PROVINCE. Gorge of Salt River, Windhoek, Bredasdorp District (Rennie).

Type in Albany Museum.

A somewhat featureless species, much larger than the foregoing, to which it bears some resemblance in form and sculpture; the largest specimens to hand, which appear to represent fully mature shells, are 8 mm. in major diameter.

# Trachycystis lunaris sp. n. (Pl. vi, f. 8–10.)

Shell small, perforate, depressed globose, nearly circular, transparent, finely silky, pale olivaceous buff. Spire little raised, apex bluntly rounded. Whorls 6, gradually increasing, moderately convex, rounded at periphery, 1st practically smooth, remainder sculptured above with exceedingly fine and close, regular, very slightly curved and oblique transverse striolae of equal strength throughout and considerably weaker on the base, and extremely fine, almost negligible microspiral lineation; suture well defined. Aperture horizontal, \(\frac{3}{4}\)-lunar, labrum nearly straight and receding little in profile, columella extremely short and weak, margin barely reflexed, but practically concealing, in adult shells, the minute umbilicus.

Diam. maj. 7.0, min. 6.8; alt. 4.5; apert. alt. 3.1, lat. 3.6 mm.

Hab. CAPE PROVINCE. Thomas R., Cathcart (type); Atherstone (Farquhar); Donkersbosch, Grahamstown (Hewitt); Port St. John's; Amabele Junction (Puzey).

ZULULAND. Melmoth (Miss Hickey).

Type in British Museum.

A featureless species which has been collected in small numbers over a wide area and appeared of too dubious status to describe until Watson assured me that the animal is distinct from its nearest allies; specimens were mixed with the type set of sollers M. & P. (aprica Krs.) and have been distributed under that name.

#### (xi) Group of minutiae.

Minute shells, seldom exceeding  $2\frac{1}{2}$  mm. in diameter; the first seven are really small members of group (iv).

#### Trachycystis mcbeani Conn.

1932. Trachycystis mcbeani Conn., Ann. Natal Mus., vii, p. 97, pl. v, f. 5. D.F.

Shell very small, depressed orbicular, umbilicate, thin, silky, corneous redbrown. Spire not greatly raised, summit obtusely rounded. Whorls 5, very convex, gradually increasing, rounded at periphery, protoconch, 2½ whorls, practically smooth, remainder covered all over with exceedingly close, straight, regular, transverse microscopic striae; suture simple, subcanaliculate. Aperture sublunate, peristome simple, acute, labrum straight, scarcely receding in profile, columella short, concave, margin triangularly reflexed, but not overhanging the rather wide, deep umbilicus.

Diam. maj. 2.2; alt. 1.3 mm.

Hab. TRANSVAAL. Pretoria (type, Connolly; McBean).
NATAL. Majuba (Connolly); Weenen (Thomasset); Enon Bush,
Richmond (Burnup).

Type in British Museum.

Except for its minute size this would find its natural place in the simplex group; it is, in fact, a miniature of ordinaria M. & P. In 1932 I published reasons for differentiating it from ugandana Smith, mcdowelli Conn., and ponsonbyi Dautz. & Germain.

#### Trachycystis kincaidi Conn.

1932. Trachycystis kincaidi Conn., Ann. Natal Mus., vii, p. 98, pl. v, f. 6. D.F.

Shell as above, but of golden-brown colour, with practically flat spire. Whorls  $4\frac{1}{4}$ , convex, gradually increasing, first  $1\frac{3}{4}$  practically smooth, remainder covered with close, regular, very slightly curved and oblique microscopic transverse costulae, gradually increasing in strength and distance apart, with almost imperceptible parallel striolae between them; suture deeply impressed. Aperture nearly circular, labrum nearly straight and vertical in profile, columella merely an upward extension of the basal margin without reflexion, umbilicus broad, deep, and tubular.

Diam. maj. 2.4; alt. 1.2 mm.

Hab. CAPE PROVINCE. Mountain Drive, Grahamstown (type); East London (Kincaid).

Type in British Museum.

Apparently somewhat nearly allied to bernardinae Conn. from Mt. Kenya and smithi D. & G. from the Belgian Congo, but distinct from either.

#### Trachycystis mcdowelli Conn.

(Pl. ix, f. 1-2.)

1922. Trachycystis mcdowelli Conn., A.M.N.H., x, p. 117. D. 1925. ,, ,, ,, Trans. R. Soc. S. Africa, xii, p. 143, pl. iv, f. 13. N.F.

A very small, silky, corneous shell with almost flat spire.  $4\frac{1}{4}$  whorls, slowly and regularly increasing, protoconch practically smooth, with faint traces of microscopic transverse striolation after the 1st whorl, remainder covered with very close, clear, nearly straight, transverse microscopic striae; suture shallow. Aperture lunate, umbilicus rather narrow, extending to the summit and just exposing all the whorls.

Diam. maj. 1.7, min. 1.5; alt. ca. 0.8 mm.

Hab. LORENZO MARQUES. Maforga Siding, B. & M. Railway (McDowell).

Type in British Museum.

A particularly neat, closely coiled little species.

#### Trachycystis venatorum Conn.

1932. Trachycystis venatorum Conn., Ann. Natal Mus., vii, p. 99, pl. v, f. 7. D.F.

Shell extremely small, subglobose, glossy, pale corneous brown. Spire moderately exserted, apex bluntly rounded. Whorls  $4\frac{1}{2}$ , very convex, somewhat shouldered, protoconch,  $1\frac{1}{4}$  whorl, smooth, next  $\frac{1}{2}$  whorl engraved with extremely close, fine, and faint microspiral lines, after which the sculpture on both sides consists of regular, rather distant, curved, oblique, weakly prominent transverse striae, cut by faint microspirals; suture much impressed. Aperture  $\frac{3}{4}$ -lunar, labrum nearly straight and vertical in profile, columella concave, inclined to the left, upper margin barely reflexed, not overhanging the deep, funnel-shaped umbilicus.

Diam. maj. 2.0, min. 1.8; alt. 1.3 mm.

Hab. NATAL. Game Pass (type); Inhluzani; Belle Vue (Burnup). Type in British Museum.

Allied to glanvilliana, but smaller, comparatively higher, with comparatively wider umbilicus.

#### Trachycystis ferarum Conn.

1932. Trachycystis ferarum Conn., Ann. Natal Mus., vii, p. 100, pl. v, f. 9. D.F.

A minute, silky, corneous yellow-brown shell, with nearly flat spire.  $3\frac{1}{2}$  convex, regularly increasing whorls, first  $1\frac{3}{4}$  practically smooth, remainder covered all over with very fine and close, straight, slightly oblique microscopic costulae, gradually increasing in distance apart, the intervals filled with exceedingly fine, close, parallel striolae; suture rather deep. Aperture  $\frac{3}{4}$ -lunar, labrum straight, receding but little, columella concave, upper margin very slightly reflexed, slightly overhanging the tubular, rather narrow umbilicus.

Diam. maj. 1.7; alt. 0.8 mm.

Hab. NATAL. Game Pass (type); Van Reenen (Burnup).

Type in British Museum.

Easily distinguishable from pura Conn. through having a much narrower umbilicus.

#### Trachycystis vengoensis Conn.

(Pl. ix, f. 3-4.)

1922. Trachycystis vengoensis Conn., A.M.N.H., x, p. 118. D. 1925. ,, ,, Trans. R. Soc. S. Africa, xii, p. 148, pl. iv, f. 16. N.F.R.

A minute, silky, reddish corneous shell with nearly flat spire, each whorl just showing above the next.  $3\frac{1}{2}$  gradually increasing whorls, protoconch microscopically reticularly punctate, remainder covered on both sides with microscopic, close, straight, regular, transverse striae, crossed by almost invisible spiral striation

round the umbilicus; suture deep. Aperture rounded lunate, columellar margin not reflexed, umbilicus not wide, but deep, extending to the summit and disclosing all the whorls.

Diam. maj. 1.45, min. 1.35; alt. 0.4 mm.

Hab. LORENZO MARQUES. Mt. Vengo, 5500 feet (Cressy).

Type in British Museum.

Somewhat nearly related to ugandana Smith and smithi D. & G., but distinct from either.

The jaw measures about  $\cdot 1 \times \cdot 02$  mm.; it is curved, very thin, with little or no visible sculpture. The radula measures  $\cdot 29 \times \cdot 11$  mm. when flattened out and resembles that of soror in general appearance, formula of two specimens  $(6+6+1+6+6) \times 72$  and  $\times 80$  respectively.

#### Trachycystis spissisculpta Conn.

1932. Trachycystis spissisculpta Conn., Ann. Natal Mus., vii, p. 100, pl. v, f. 11. D.F.

A minute, depressed globose, glossy, pale corneous brown shell, spire not much exserted, apex obtuse.  $4\frac{1}{2}$  convex whorls, regularly increasing, first  $1\frac{3}{4}$  practically smooth, remainder covered on both sides with very weak, curved, oblique, subdistant microscopic striae, probably representing intervals of growth, the intervals filled with exceedingly fine parallel striolae and the whole cut by equally fine, close and regular microspiral grooves; suture impressed. Aperture \(\frac{3}{4}\)-lunar, labrum evenly receding, columella concave, short and weak, margin scarcely reflexed, umbilicus moderately wide, openly exposing all the whorls.

Diam. maj. 1.8; alt. 1.0 mm.

Hab. NATAL. Van Reenen (Burnup).

Type in British Museum.

The glossy surface, weak transverse and strong spiral sculpture combine to distinguish this species from others of the group, but it bears rather close resemblance to the Abyssinian cryophila Mts.

# Trachycystis pura Conn.

(Pl. ix, f. 7-8.)

1922. Trachycystis pura Conn., A.M.N.H., x, p. 118. D.

1925. Trans. R. Soc. S. Africa, xii, p. 146, pl. iv, f. 15. N.F.A.R.

1934. Trachycystis pura Conn., Watson, Proc. Mal. Soc., xxi, p. 168. N.

A minute circular shell with nearly flat spire and milky translucent texture; 3½ whorls, slowly and regularly increasing, covered all over with close, strong, regular, nearly straight transverse striae, which are about .025 mm. apart on the last whorl, but closer towards the apex, except on the first half of the 1st whorl, where they are slightly more distant than on the second half; protoconch furnished with almost invisible microspiral striae, which also occur round the umbilicus; suture narrow but well defined. Aperture rounded lunate, umbilicus rather wide, extending to the summit and exposing all the whorls.

Diam. maj. 1.2, min. 1.0; alt. 0.7 mm.

Hab. LORENZO MARQUES. Mt. Vengo, 5500 feet (type, Cressy). CAPE PROVINCE. Kowie (Kincaid); Thomas River, Cathcart (Miss Davidson).

Type in British Museum.

Easily distinguishable from its minute confrères by its milky colour and comparatively strong, close radial striae; the largest shell from Cathcart contains  $3\frac{1}{2}$  whorls with major diameter of  $1\cdot 4$  mm.

The radula in this species, as well as the shell and kidney, is of a slightly specialised type; it measures  $32 \times 105$  mm. when flattened out, formula  $(6+3+1+3+6)\times 66$ ; the backward trend of the laterals and the large size of the first on each side make it easy to distinguish from most of those of which the radula has been published, though resembling in some respects that of the American *Helicodiscus lineatus* (Say).

Watson (1934) remarks "T. pura Conn. resembles T. charybdis Bs. in the sculpture of its protoconch, but not in the shape and minute size of the shell nor in the radula and kidney . . . undoubtedly, therefore, T. pura belongs to a distinct sub-genus, if not to a different genus of the Endodontidae." However this may be, my little species can easily be sought and found among the minutiae, and I prefer to leave it here for the present, rather than create a new and possibly unnecessary home for it.

Trachycystis microscopica (Krs.). (Pl. vii, f. 12–14.)

Ref. List No. 257.

1848. Helix microscopica Krs., Südafr. Moll., p. 76, pl. iv, f. 20. D.F.

1936.  $Trachycystis\ microscopica\ Krs.,\ Haas,\ Abh.\ Senckenb.\ Ges.,\ No.\ 431,\ p.\ 20.$  L.

Shell microscopic, conoid, umbilicate, thin, silky, transparent, pale corneous brown. Whorls  $3\frac{1}{2}$ , regularly increasing, convex, very obtusely angled at the periphery, first  $2\frac{1}{4}$  smoothly micropunctate, remainder covered above with very weak, close, slightly oblique transverse striolae, which are much finer on the base; suture well defined. Aperture nearly oblong, angled at periphery and base of columella, which is straight and erect, margin rather broadly reflexed, partly concealing the narrow umbilicus.

Alt. (type) ca. 1·1, lat. 1·3 mm.

Hab. NATAL. Mooi River (type, Wahlberg).

ZULULAND. St. Lucia Lagoon (Haas).

Type in Stockholm Museum.

It is difficult to determine the generic status of this little species; while not a *Pupisoma*, it bears suspicious resemblance to the top of a *Pupilla*, but I cannot identify it as such; the Zulu record appears to me doubtful.

(xii) Group of perplicata Bs.
Sub-genus Lyrocystis Watson, 1934
(Proc. Mal. Soc., xxi, p. 170).
Type Helix cosmia Pfr.

Hinder part of foot in  $T.\ cosmia$  rounded above, not keeled; upper extension of kidney running forward for a short distance next to rectum; duct of spermatheca enlarged at anterior end; first part of vas deferens unusually thick, generally forming a loop near posterior end of free oviduct. Epiphallus moderately long, entering one side of hinder end of the broad, rather short penis, the opposite side of which is continued into a small oval appendix, with the unusually slender penial retractor attached to its apex.

Central and lateral teeth with anterior end of basal part of mesocone extremely narrow, or absent from laterals in T cosmia; marginals with moderately long, pointed mesocones, somewhat smaller endocones, and ectocones that are usually divided into 2, or sometimes 3 narrow cusps in the outer teeth.

Watson assigns to this sub-genus cosmia Pfr. and perplicata Bs.

### Trachycystis cosmia (Pfr.). Ref. List No. 119.

1850. Helix munda Bs., A.M.N.H., vi, p. 253. D.

1851. ,, cerea (= munda Bs., 1850, non Adams, 1849) Pfr., Zeitschr. f. Mal., viii, p. 16. N.

1852.  $Helix\,cosmia$  (= cerea Pfr., 1851, non Gld., 1850) Pfr., Zeitschr. f. Mal., ix, p. 112. N.

1864. Helix omphalion Bs., A.M.N.H., xiii, p. 494. D.

1934. Trachycystis cosmia Pfr., Watson, Proc. Mal. Soc., xxi, p. 170, pl. xx, f. 20–21. A.R.

Shell very small, depressed globose, thin, silky, transparent, corneous greenish-brown. Spire not much exserted, apex obtusely rounded. Whorls  $4\frac{1}{2}$ , moderately convex, regularly increasing, first  $1\frac{1}{2}$  engraved into the apex with extremely close and fine microscopic spiral lines, remainder sculptured all over with strong, close,

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regular, curved, oblique transverse costulae; the spiral engraving continues very faintly in the interstices between the costulae on the intermediate whorls, but practically disappears on the last whorl and base; suture simple, rather deep. Aperture  $\frac{5}{6}$ -lunar, peristome simple, acute, labrum nearly straight and receding regularly in profile, columella concave, margin scarcely reflexed, not obscuring the narrow, deep umbilicus. The largest perfect example in the British Museum measures

Diam. maj. 5.9, min. 5.0; alt. 3.6; apert. alt. 2.5, lat. 2.5 mm.

Hab. CAPE PENINSULA. Lion's Head, near Camps Bay (munda, Benson); top of Table Mountain overlooking Cape Town (cerea, Layard); Kalk Bay (Lightfoot); Simonstown (omphalion, "fice Hawkins," Benson).

CAPE PROVINCE. Riversdale; Riebeek Kasteel Mts., 2800 feet (Barnard).

Type of  $cosmia\ ubi$ ? Specimens of omphalion ex auct. in Cambridge Museum.

# Trachycystis perplicata (Bs.).

Ref. List No. 263.

1851. Helix perplicata Bs., A.M.N.H., vii, p. 104. D.

1855. Helicopsis tabulae Chaper, Bull. Soc. Zool. Fr., x, p. 483, pl. xi, f. 4-5. D.F.

1892. *Helix* (*Pella*) rhysodes M. & P., A.M.N.H., ix, p. 87, pl. iv, f. 2. D.F.

1934. Trachycystis perplicata Bs., Watson, Proc. Mal. Soc., xxi, p. 171. N.

Shell of moderate size, subglobose, umbilicate, thin, asperate, semi-transparent, corneous yellow-brown, with occasional traces of narrow rufous rays. Spire moderately exserted, apex obtuse. Whorls 6, convex, slightly shouldered at periphery, regularly increasing, first 1½ engraved with extremely close and fine microscopic spiral lines, remainder sculptured all over with strong, curved, oblique transverse costae, gradually increasing in distance apart, the intervals filled with fine parallel striolae, which are cut by the continued spiral sculpture of the 2nd whorl; suture simple, somewhat impressed. Aperture ¾-lunar, labrum nearly straight and receding very gradually in profile, columella very short, concave, margin narrowly triangularly reflexed, but scarcely overhanging the narrow, deep umbilicus.

Diam. maj. 7·2, min. 6·4; alt. 5·1; apert. alt. 3·8, lat. 3·4 mm.

Hab. CAPE PENINSULA. Near Newlands (type, Benson); Table Mountain (tabulae, Chaper); widely distributed from Table Mountain to Cape Point.

CAPE PROVINCE. Port Elizabeth (fide Sturany); Palmiet R. Mountains, 2000 feet (Barnard).

The type of rhysodes, from an unknown locality, in the British

Museum, is identical with *perplicata*, of which there are originals in the Cambridge Museum—that of *tabulae* is in École des Mines, Paris; had the authors of either of these species compared them with that of Benson there would have been no need to describe them as new.

Shell described, from the Cape Peninsula, in my collection.

#### Trachycystis prionacis (Bs.). Ref. List No. 267.

1864. Helix prionacis Bs., A.M.N.H., xiii, p. 493. D.

1864. ,, browningii Bs., ibid., p. 493. D.

1892. ,, (Pella) erateina M. & P., A.M.N.H., ix, p. 88, pl. v, f. 3. D.F.

1934. Trachycystis prionacis Bs., Watson, Proc. Mal. Soc., xxi, p. 176. N.

Shell small, somewhat depressed, umbilicate, thin, asperate, transparent, pale corneous brown, with transverse rufous flames on the upper surface. Spire, moderately exserted. Whorls 4½, regularly increasing, moderately convex, carinate at the periphery, apical ½ engraved with close, regular, microspiral lines, remainder sculptured with strong, curved, slightly oblique costae, gradually becoming wider apart, strongest at the periphery and weaker on the base, the interstices filled with parallel microscopic striolae and extremely faint traces of the apical microspiral sculpture; suture simple, well defined. Aperture subrhomboid, labrum gradually receding to the base, columella short, concave, margin little reflexed, not obscuring the rather narrow umbilicus. The largest specimen available (type of erateina) measures

Diam. maj. 4.6, min. 4.2; alt. 2.6; apert. alt. 1.7, lat. 2.2 mm.

Hab. CAPE PROVINCE. Bredasdorp (prionacis and erateina, Layard).

CAPE PENINSULA. Near Cape Point (browningii, Browning; erateina, Layard); Table Mountain (Connolly).

Type of *erateina* in British Museum; originals of *browningii* in Cambridge Museum; *prionacis* probably in British Museum.

The shell bears a somewhat close superficial resemblance to that of *Goniodiscus rotundatus* (Müll.); Watson suggests that it belongs to a distinct sub-genus; for the present it seems best placed here.

# Trachycystis erythractis Conn.

Ref. List No. 243.

1912. Trachycystis erythractis Conn., Ann. S.A. Mus., xi, p. 136, pl. ii, f. 5. D.F.

Shell depressed conoid, subrimate, rather thin and dull, hardly translucent, pale cream, decorated above with irregular ruby rays and streaks. Spire moderately

exserted, apex narrowly rounded. Whorls  $5\frac{1}{2}$ , gradually increasing, rounded, with very slight angulation at the periphery, first 2 sculptured with very close, fine microspiral, cut by equally fine and close radial lines; on the later whorls the transverse sculpture becomes stronger, slightly curved and oblique, and the spiral weaker, all fainter on the base; suture shallow. Aperture compressed oval, labrum receding in gentle curve, columella short, thickened upwards, margin narrowly reflexed, almost concealing the narrow perforation.

Diam. maj. 10·1, min. 8·9; alt. 6·8; apert. alt. 5·2, lat. 5·4 mm.

Hab. CAPE PROVINCE. Caledon Division (Lightfoot).

Type in South African Museum.

Nearest to *perplicata*, from which it is easily distinguishable by its far narrower perforation and smoother sculpture.

(xiii) Group of capensis Pfr.
Sub-genus Xerocystis Watson, 1934
(Proc. Mal. Soc., xxi, p. 178).
Type Helix capensis Pfr.

Hinder part of foot rounded above, not keeled; upper extension of kidney tending to run forward for a short distance next to the rectum. Duct of spermatheca slightly enlarged at anterior end; vagina rather long; epiphallus of moderate length, entering side of the somewhat swollen penis a short distance from its hinder end, to which the penial retractor is attached. Jaw thin, with vertical folds, as in all the preceding sub-genera; mesocones of marginals not as long as usual except in the transitional teeth; endocones moderately short; ectocones very seldom divided. Shell whitish, usually with brown bands or spots.

Xerocystis includes the smaller forms which were formerly placed in *Phortion (Phasis)* but prove by their anatomy to be sub-generically distinct.

 $Trachy cystis\ capensis\ (Pfr.)$  (=  $irrorata\ Ziegl.\ and\ littoricola\ Bs.\ in\ litt.).$ 

Ref. List No. 217.

1841. Helix capensis Pfr., Symb., i, p. 40. D.

1887. ,<br/>, (Pella) capensis Pfr., Tryon, Manual, iii, p. 103, pl. xx, f. 61. <br/> D.F.

1934. Trachycystis capensis Pfr., Watson, Proc. Mal. Soc., xxi, p. 178, pl. xxi, f. 29–30. N.A.R.

Shell small, depressed globose, umbilicate, somewhat calcareous, nearly smooth, fairly glossy, white or buff, with or without a single narrow brown band on upper part of whorl and a few small irregular black dots, and innumerable patterns of transverse ornamentation in the form of brown streaks, flames, and patches, with

a black patch in umbilicus. Spire moderately exserted, apex narrowly rounded. Whorls 5, regularly increasing, convex, rounded at periphery, first 1½ practically smooth, remainder bearing close, faint, slightly curved and oblique growth striolae, with vestiges on the base of microspiral grooves; suture well defined. Aperture ¾-lunar, labrum nearly straight and vertical in profile, columella erect, nearly straight, margin narrowly reflexed, overhanging nearly half the narrow umbilicus. A specimen from Kommetje of average size measures

Diam. maj. 9.4, min. 8.0; alt. 6.6; apert. alt. 4.7, lat. 4.5 mm.

Hab. CAPE PENINSULA. Very common, especially along the coast.

CAPE PROVINCE. Widely distributed from Port Elizabeth to Namaqualand (Crawford and others); Bredasdorp (Rennie); Keurbooms R. bush; Kleinmond, near Hermanus, sand dunes near coast (Barnard); Port Alfred (Penther); East London (Puzey); Humansdorp (Rogers).

Type in Stuttgart Museum.

var. namaquana Mts. (Pl. vii, f. 4.) Ref. List No. 219.

1889. Helix (Pella) namaquana Mts., Sitz.-Ber. Ges. Nat. Fr., Berlin, p. 161. D.

Merely a large, well-grown form of capensis, scarcely meriting varietal status, since examples quite as large and completely identical with Martens' Nama-qualand race have been collected by Lightfoot in the Cape Peninsula, where, however, they seldom attain so large a size; an average example from Port Nolloth, with 6 very convex whorls, measures

Diam. maj. 11-1, min. 9-6; alt. 7-5; apert. alt. 5-7, lat. 5-3 mm.

Hab. LITTLE NAMAQUALAND. Between Port Nolloth and Ananas (type, Schenck; Day).

CAPE PENINSULA. Muizenberg (Lightfoot).

Type in Berlin Museum.

var. paludicola Bs. Ref. List No. 220.

1850. Helix paludicola Bs., A.M.N.H., vi, p. 253. D.

It may be possible to retain this name for the race of small shells which inhabits the type locality and perhaps a few other damper spots than those frequented by the more solid typical form; they are very slightly less solid than usual and occasionally ornamented with a large number of close, very narrow purple bands which impart rather a distinctive appearance to the shell.

Hab. CAPE PENINSULA. "Baszaarms" (Baas Harman's) Kraal, near Retreat (type, Benson); Seekoe Vlei (Connolly).\* Originals in Cambridge Museum.

Trachycystis uitenhagensis (Pfr.).
(Pl. vii, f. 1-3.)
Ref. List. No. 222.

1846. *Helix uitenhagensis* Krs., Pfr., Symb., iii, p. 66. *D*. 1848. ,, ,, Südafr. Moll., p. 76, pl. iv. f. 22. *D.F*.

Much larger than normal capensis, attaining the size of var. namaquana, from which it differs in more regularly conical spire, much flatter whorls with stronger transverse sculpture and duller texture, narrower umbilicus without black patch, more mamillate apex, and faint, blunt, peripheral angulation. 6 nearly flat whorls, bluntly angulate at periphery, first 2 practically smooth, pale brown, remainder bearing very close, fine, regular, slightly curved and oblique transverse striae, with extremely close, fine, faint microspiral lineation; pale cream with occasional dark narrow streaks and a number of small, irregular dark dots; suture simple, shallow. Aperture roundly, obliquely quadrate, labrum nearly straight, receding slightly to base, columella very short, erect, margin narrowly triangularly reflexed, scarcely overhanging the very narrow umbilicus. The type measures

Diam. maj. 10·4, min. 9·0; alt. 8·2; apert. alt. 5·3, lat. 4·9 mm.

Hab. CAPE PROVINCE. Foot of Winterhoek Mountain, Uitenhage (Krauss; Layard).

Type in Stuttgart Museum.

Judging from the type, which has been the only specimen available for examination, this species is abundantly distinct from *capensis*. Layard wrote: "I look upon this as the inland variety of the preceding species. I found it moderately plentiful in the neighbourhood of the village of Uitenhage on the gravelly soil on low bushes; it was not nearly so abundant as *H. capensis* in its own locality; it has more whorls and a more exserted spire than *H. capensis*, but partakes of all the varieties from pure white to dark mottled specimens."

Krauss' figure accurately represents the flattish whorls and regularly conical spire, but the aperture is too horizontal, hardly sufficiently descending, and there is no sign of the faint but distinct peripheral angulation.

<sup>\*</sup> In the Trig. Survey's recent contour map of the district, the eastern limit of "Cape Peninsula" is a vertical line drawn just west of Seekoe Vlei, between itself and Ronde Vlei, so that it now lies actually within the boundary of the "Cape Province."

Trachycystis chondrocycloides Conn.

1925. Trachycystis chondrocycloides Conn., A.M.N.H., xv, p. 471, pl. xxviii, f. 11. D.F.

1934. Trachycystis chondrocycloides Conn., Watson, Proc. Mal. Soc., xxi, pp. 178, 179, pl. xxi, f. 31. N.A.R.

Shell of moderate size, depressed conoid, umbilicate, asperate, glossy, somewhat calcareous, first 2 whorls bright corneous brown, remainder creamy white with a few dark streaks or patches and rare dark dots. Spire moderately elevated, sides roundly gradate, apex mamillate. Whorls 4½, regularly increasing, very convex, rounded at periphery, first 1½ practically smooth, remainder covered all over with close, regular, rather coarse, curved, oblique transverse striae: suture rather deep. Aperture nearly circular, labrum receding sharply to the base, columella erect, concave, margin rather broadly triangularly reflexed, but not overhanging the deep and moderately wide umbilicus.

Diam. maj. (type) 6.2, min. 5.7; alt. 4.0; apert. alt. 2.2, lat. 2.2 mm.

Hab. LITTLE NAMAQUALAND. One mile north of Port Nolloth (Rogers); Richtersveld (G. E. Smith).

Type in South African Museum.

The type set were in bleached condition, but those from Richtersveld alive, which enables the exact systematic position and coloration of this rare species to be determined.

The peristome is not, as assumed by Watson, usually detached and continuous in fully grown specimens, although occasionally so; it is a feature which, he points out, together with unusually broad mesocones of the central and lateral teeth of the radula, is prevalent among the desert races of south-west Africa.

(xiv) Group of menkeana Pfr.

Sub-genus Phortion Preston, 1910

(A.M.N.H., vi, p. 531)

(=Phasis Albers, 1850, non Hübner, 1816).

Type Helix menkeana Pfr.

Shell depressed globose, comparatively large; protoconch about  $2-2\frac{1}{2}$  mm. in diameter, not mamillate, gradually developing low radial ribs and microspiral striae; later whorls with coarse spiral

striae crossed by radial striae and ribs of varying strength.

Hinder part of foot usually somewhat angular above, but not sharply keeled. Duct of spermatheca much enlarged towards anterior end; vagina with protuberance on ventral side, bluntly conical in most species, but forming a short diverticulum, curving backwards, in *lightfootiana*. Epiphallus of medium length or rather long, entering the broad anterior part of penis close to its hinder end. Beyond the entrance of the epiphallus the penis is continued in the form of a narrower appendix of no great length, which usually lies nearly at right angles to the broad part of the penis, and to the end of which the penial retractor is attached.

Jaw not folded, but covered with fine and close vertical striae; often less thin than it is in other groups of the genus. Central and lateral teeth with anterior end of basal part of mesocone extremely narrow; marginals with blunt mesocones, smaller but more sharply pointed endocones, and small undivided ectocones.

Watson's elimination of the *capensis* group and introduction into *Phortion* of several larger forms, hitherto placed for the most part in different families, shows it to be a fairly homogeneous group, chiefly notable for strong spiral sculpture and considerable depth of whorl.

# Trachycystis menkeana (Pfr.).

Ref. List No. 218.

1842. Helix menkeana (=capensis Mke., ined.) Pfr., Symb., ii, p. 33. D.

1874. Helix menkeana Pfr., Smith, Zool. Exp. Erebus & Terror, Moll., p. 2, pl. iv, f. 9. N.F (pessime).

1893. Phasis menkeana Pfr., Pilsb., Manual, ix, p. 37, pl. x, f. 1-3. F.

1934. Trachycystis menkeana Pfr., Watson, Proc. Mal. Soc., xxi, p. 181. N.

Shell of fair size, discoid, umbilicate, nearly smooth, rather dull, white or buff, with from 1 to 6 brown or chestnut bands, one above persistent and usually far broader, remainder on and below periphery; the upper band is occasionally very faint and in rare cases absent. Spire usually flat, only the extreme apex showing above it in profile. Whorls  $4\frac{3}{4}$ , rather rapidly increasing, flat above, rounded at periphery, first  $1\frac{1}{2}$  sculptured with most extremely fine and close microspiral lines, only visible in freshest condition, remainder with very close, regular, curved, slightly oblique transverse striolae and more distant microspiral grooves, again only visible in fresh condition; suture simple, shallow. Aperture  $\frac{3}{4}$ -oval, horizontal, labrum straight, receding little in profile, columella concave, inclined to left, margin scarcely reflexed, umbilicus narrow, but exposing all the whorls; a specimen from Buffelsfontein, Cape Point, measures

Diam. maj. 22.5, min. 19.2; alt. 12.6; apert. alt. 10.3, lat. 11.0 mm.

Hab. CAPE PROVINCE. Elim, Bredasdorp Dist. (probable type, Krauss).

CAPE PENINSULA. Widely distributed.

Type in Stettin Museum.

#### Trachycystis hartvigiana (Pfr.). Ref. List No. 247.

1861. Helix hartvigiana Pfr., Mal. Blätt., viii, p. 167. D. (Pella) hartvigiana Pfr., Tryon, Manual, iii, p. 107, pl. xx, f. 89-91. D.F.

Agrees in colour, shape and size with tollini, except for having a rather less narrow umbilicus, but differs in sculpture. There are 5 deep, rounded, regularly increasing whorls, the first  $1\frac{1}{2}$  smooth and glossy, the next covered with extremely close, fine, nearly straight, slightly oblique transverse striae, which are crossed about the end of the whorl by fine, regular, comparatively distant spiral grooves; both forms of sculpture gradually become stronger on the succeeding whorls, while strong transverse costae are developed at regularly increasing intervals, at first with about 6 and finally about 10 intermediate parallel striolae; suture simple, well defined; columella extremely short, margin triangularly reflexed, half covering the narrow umbilicus.

Diam. maj. 15.7, min. 13.6; alt. 11.0; apert. alt. 8.8, lat. 8.0 mm.

Hab. CAPE PROVINCE. Genadendal, near Caledon (type, Hartwig); Oudebosch, River Zonder End Mts. (Layard).

Type in Stettin Museum.

Description from topotype in British Museum.

#### Trachycystis cancellata (Conn.).

1925. Sheldonia cancellata Conn., A.M.N.H., xv, p. 468, pl. xxviii, f. 5. D.F.

1934. Trachycystis cancellata Conn., Watson, Proc. Mal. Soc., xxi, pp. 180, 181, pl. xxi, f. 36. N. Jaw.

Shell comparatively large, globose, subrimate, silky, corneous red-brown. Spire little raised. Whorls 4, moderately convex, very rapidly increasing, the last much swollen, embracing nearly the entire shell; 1st whorl of protoconch  $(1\frac{1}{2}$ whorls) glossy, practically smooth, next ½ whorl showing slightly curved transverse striae, next ½ whorl covered with close, regular, nearly straight, transverse costulae at right angles to the suture; on the last 2 whorls the costulae become fainter and gradually farther apart, with 3 or 4 fainter striae in the intervals between them, and are crossed by close, regular, spiral ridges, the whole imparting to the shell, both above and beneath, a beautiful silky sheen; suture simple, well defined. Aperture suboval, more broad than high, descending a little at the base, labrum nearly straight and not receding in profile, columella weak, concave, margin narrowly but closely reflexed, almost concealing the narrow rima.

Diam. maj. 20.2, min. 15.8; alt. 13.2; apert. alt. 10.8, lat. 11.9 mm.

Hab. CAPE PROVINCE. Knysna (type, Drury; Barnard). Montagu Pass, Outeniqua Range, north of George (Haughton).

Type in South African Museum.

Trachycystis lightfootiana (M. & P.).

Ref. List No. 126.

1909. Natalina lightfootiana M. & P., A.M.N.H., iv, p. 490, pl. viii, f. 13. D.F.

1934. Trachycystis lightfootiana M. & P., Watson, Proc. Mal. Soc., xxi, p. 180, pl. xxi, f. 34-35. A.R.

Shell moderately large, depressed globose, umbilicate, thin, silky, semi-transparent, pale corneous brown, paler on base. Spire nearly flat, apex obtuse. Whorls 4½, moderately convex, rounded at the periphery, regularly increasing, 1st smooth, remainder sculptured all over with close, regular, curved transverse striae, which increase in strength on the last 2 whorls, and very close, regular, slightly undulating, incised spiral lines; suture simple, well defined. Aperture ¾-lunate, descending slightly at base, peristome simple, acute, labrum receding slightly to the base, columella short, weak, inclined to the left, margin triangularly reflexed, but not obscuring the narrow, deep, and open umbilicus.

Diam. maj. 20.7, min. 17.5; alt. 13.1; apert. alt. 10.8, lat. 10.0 mm.

Hab. CAPE PROVINCE. Swellendam (type, Lightfoot); Montagu (Connolly); 4 miles south of Bredasdorp (Lawrence).

Type in British Museum, in somewhat weather-beaten condition. Description of my largest shell from Montagu.

Trachycystis barnardi sp. n. (Pl. ix, f. 15–17.)

Very similar to the last, but of comparatively greater diameter, owing to more rapid increase of whorl, the aperture being thus wider and depth of whorl less than in lightfootiana. The sculpture is weaker, whorls less convex, suture more shallow, and umbilicus narrower and less open. Shell large, depressed globose, slightly silky and glossy, corneous olive-brown. Spire little exserted, whorls 5, little convex, regularly increasing, transverse sculpture consisting of weak, somewhat irregular growth wrinkles, spiral, when visible, similar to that of lightfootiana, fairly strong close grooves below the sutures and on base; suture well defined. Aperture oblong, \(\frac{3}{4}\)-lunate, scarcely descending, labrum receding gradually to base, columella extremely short, much inclined to left, margin narrowly triangularly reflexed, half overhanging the narrow umbilicus.

Diam. maj. 23·3, min. 19·8; alt. 14·0; apert. alt. 10·1, lat. 10·8 mm.

Hab. CAPE PROVINCE. Zwartberg Pass, Prince Albert (Barnard). Type in South African Museum.

Trachycystis gilliana sp. n.

(Pl. ix, fig. 30–31.)

Shell comparatively large, depressed globose, umbilicate, thin, semitransparent, slightly silky, corneous yellow-brown. Spire little raised, apex obtuse. Whorls 4, regularly increasing, moderately convex, rounded at periphery, protoconch, 1½ whorl, smoothly malleate, remainder bearing fairly close and regular, moderately curved and oblique growth lines, interspersed with very close, weak, parallel

striolae, and crossed on the base by close, weak, zigzag spiral grooves. Aperture \( \frac{3}{4}\)-lunate, descending slightly at base, peristome simple, columella short, concave,

margin triangularly reflexed, but little overhanging the narrow umbilicus. Diam. maj. 21·4, min. 18·5; alt. 15·0; apert. alt. 10·9, lat. 11·6 mm.

Hab. CAPE PROVINCE. Dassieberg Mts. behind Robertson (Barnard).

Type in South African Museum.

Although the unique type was collected in live condition and the animal is in the possession of H. Watson, who confirms its position in *Phortion*, the shell is somewhat weatherbeaten, so that, although it is perfectly uniform in colour, it appears patchy in the photographs here reproduced, owing to the weathered patches appearing white through the lens.

I have great pleasure in naming this fine species in honour of the Director of the South African Museum.

#### Trachycystis oconnori (Prest.). Ref. List No. 129.

1912. Natalina oconnori Prest., A.M.N.H., ix, p. 445. D.F.

1934. Trachycystis oconnori Prest., Watson, Proc. Mal. Soc., xxi, p. 181, pl. xxi, f. 32–33. N.A.R.

Shell rather small, subglobose, practically imperforate, thin, silky, transparent, very pale corneous yellow. Spire not much elevated, apex obtuse. Whorls 4, rather flat above but inflated below, rapidly increasing, rounded at periphery, protoconch, 1\frac{3}{4} whorl, covered with exceedingly close and fine microscopic spiral and radial lines, so extremely faint as to be scarcely visible under 20-fold magnification on the freshest specimens, remainder sculptured above with close, regular, curved, oblique transverse striae, cut by equally close spiral grooves, visible under a weak lens; on the base the transverse striae are much weaker and the spiral hardly visible; suture simple, narrowly impressed. Aperture \frac{3}{4}-lunate, peristome simple, acute, labrum receding regularly, columella short, concave, margin so minutely reflexed that there is practically no rimation.

Diam. maj. 11.8, min. 10.1; alt. 8.5; apert. alt. 7.5, lat. 7.0 mm.

Hab. CAPE PROVINCE. Ceres District, on Euphorbia (O'Connor).

Type ubi?

Description of paratype in my collection.

(xv) Sub-genus Liparocystis Watson, 1934 (Proc. Mal. Soc., xxi, p. 182).

Monotype Zingis delicata M. & P.

Hinder end of foot laterally compressed but not keeled; kidney slightly longer and narrower than in most of the genus, though of essentially the same type. Duct of spermatheca enlarged towards anterior end; vagina broad posteriorly, contrasting strongly with the very narrow, sinuous free oviduct; epiphallus moderately long, entering side of penis towards its hinder end. Beyond the entrance of the epiphallus the penis is continued in the form of a very short appendix, directed laterally, with the short and stout penial retractor attached to its side. Jaw thin, with weak vertical folds; mesocones of central and laterals but little narrowed anteriorly, those of marginals very blunt, especially in the outer teeth; endocones of marginals prominent, strongly curved, occasionally bifid, and having from 2 to 4 small, slender accessory cusps between them and mesocone; ectocones normally undivided.

#### Trachycystis delicata (M. & P.). Ref. List No. 137.

1895. Zingis delicata M. & P., A.M.N.H., xv, p. 163, pl. xii, f. 1. D.F.

1934. Trachycystis delicata M. & P., Watson, Proc. Mal. Soc., xxi, pp. 182, 183, pl. xxi, f. 37–39. D.A.R.

Shell comparatively large, depressed globose, imperforate, thin, smooth, glossy, transparent, corneous red-brown. Spire not much exserted, apex broadly rounded. Whorls 5, nearly flat, rounded at the periphery, regularly increasing, first 2 almost smooth but for weak microscopic growth wrinkles, which gradually become stronger and crossed on the succeeding whorls by close, regular, spiral lines; basal sculpture similar; suture simple, shallow. Aperture \(\frac{3}{4}\)-lunate, peristome simple, acute, labrum straight and receding little in profile, columella oblique, concave, thickened but not reflexed.

Diam. maj. (type) 16.0, min. 13.5; alt. 9.7; apert. alt. 8.0, lat. 8.2 mm.

Hab. CAPE PROVINCE. Knysna District (type, Cox; O'Connor; Purcell); Humansdorp; Keurbooms R. bush; Meiringspoort Berg, Zwartberg Range, Prince Albert, 6500 feet (Barnard).

Type in British Museum.

A fine species, easily recognised by its glossy surface and rufous colour; the pair from Meiringspoort differ from type in being narrowly umbilicate and black-brown in colour.

(xvi) Sub-genus *Chilocystis* Watson, 1934 (Proc. Mal. Soc., xxi, p. 174). Type *Helix* (*Pella*) lygaea M. & P.

Shell lenticular or depressed turbinate, whorls more or less angular or carinate at periphery, ventricose below but usually flattish above;

protoconch usually showing traces of faint microspiral sculpture, later whorls with coarser spiral striae, radial striae, and rather weak radial ribs, on which the periostracum is often produced into hairs or other processes, especially at the periphery.

Hinder part of foot rounded above, not keeled; fringe partly crossed at posterior end by a median groove, which passes back from the angle formed by the junction of the two peripodial grooves and constitutes a somewhat rudimentary caudal mucous pore. Duct of spermatheca enlarged towards anterior end; epiphallus very long, entering side of penis at or a little behind the middle of its length; penis swollen in the middle, but tapering in rear to a blunt point to which the penial retractor is attached. Radula with basal parts of mesocones of central and lateral teeth somewhat narrowed anteriorly; marginals with large, rather bluntly pointed mesocones, much smaller endocones, and ectocones which are single in some species, but in others are divided into 2 or 3 small cusps.

Watson places in this sub-genus certain species which can be divided into three very distinct groups by the epidermis being (a) unadorned, (b) hirsute, and (c) flanged at periphery, a convenient division on purely conchological grounds.

(a) Group of lygaea M. & P.; epidermis unadorned by hairs or peripheral laminae.

> Trachycystis lygaea (M. & P.). Ref. List No. 255.

1892. Helix (Pella) lygaea M. & P., A.M.N.H., ix, p. 85, pl. iv, f. 7. D.F.

1934. Trachycystis lygaea M. & P., Watson, Proc. Mal. Soc., xxi, p. 174, pl. xxi, f. 27–28. D.A.R.

Shell of fair size, depressed, narrowly umbilicate, thin, transparent, corneous buff; 6 whorls, moderately convex, rather gradually increasing, carinate at the periphery, the keel becoming blunter toward the aperture, protoconch, 21 whorls, engraved with extremely fine evanescent microspiral lines, only discernible in freshest condition, remainder covered all over with rather coarse and distant, slightly irregular, curved oblique costulae, the interstices filled with extremely fine, faint, microscopic striolae, cut by strong, close, regular microscopic spiral grooves, which undulate on the base; suture simple, well defined. Aperture subquadrate, angulate at periphery, peristome inclined to slight reflexion, labrum nearly straight and receding a little in profile, columella concave, margin triangularly reflexed, not overhanging the narrow umbilicus; callus thin and colourless. Diam. maj. 12.0., min. 10.2; alt. 7.4; apert. alt. 4.8, lat. 5.4 mm.

Hab. NATAL. Pietermaritzburg (type, Burnup); Umhlali (Rump).

Type in British Museum.

Description of topotype in my collection.

A pretty delicate species, by no means common, but easily recognisable.

Trachycystis aprica (Krs.). (Pl. vii, f. 6-8). Ref. List Nos. 221, 230.

1848. *Helix aprica* Krs., Südafr. Moll., p. 77, pl. iv, f. 26. *D.F.* 1907. (?) *Phasis sollers* M. & P., A.M.N.H., xix, p. 100, pl. vi, f. 4. *D.F.* 

Smaller than the foregoing, with weaker transverse sculpture, rather blunter peripheral carination and narrower umbilicus; colour carneo-corneous. 5 convex whorls, rather rapidly increasing, first 1½ densely micromalleate, remainder covered all over with very faint, curved, oblique transverse striae, with a stronger growth line at frequent intervals, cut by regular spiral grooves which increase in strength and distance apart on the later whorls; on the base the transverse striae are more regular and of equal strength, and the spirals absent from the umbilicus; suture well defined. Aperture obliquely ¾-lunate, peristome very slightly expanded when fully mature, labrum slightly curved and receding a little in profile, columellar margin very narrowly reflexed, but half covering the narrow umbilicus.

Diam. maj. 8·3, min. 6·5; alt. 5·3; apert. alt. 3·7, lat. 4·2 mm.

Hab. NATAL. Port Natal (type, Wahlberg). CAPE PROVINCE. Pirie Forest (Godfrey). ZULULAND. Melmoth (sollers, Miss Hickey).

Type of aprica, described above, in Stuttgart, sollers in British Museum.

Phasis sollers is identical with aprica, of which there was no authentic example in England at the time M. & P. described their species; while their type agrees perfectly in every detail of form and size with aprica, it is too weathered to show the sculpture very clearly; but in a younger, fresher paratype of sollers this feature also agrees with that of Krauss' species and establishes their complete synonymy.

The original lot of aprica contained two distinct species, of which one of each is in the "type" pair and two of each in my collection; Krauss considered the smaller shells to be young of the larger and stressed the difference between them in his description. It is fortunately easy to determine that the true aprica is the larger form, of which I possess an immature example in perfect agreement with the mature. The other species, which he considered to be young aprica, is described below.

Trachycystis conica sp. n.

(Pl. vii, f. 9.)

1848. Helix aprica (pars) Krs., Südafr. Moll., p. 77. N.

1934. Trachycystis species, Watson, Proc. Mal. Soc., xxi, pp. 168, 176. N.A.

Shell small, conical above, inflated beneath, umbilicate, very thin, diaphanous, silky, pale olivaceous. Spire moderately exserted, sides straight, apical angle about 102°. Whorls 4½, moderately convex, regularly increasing, sharply carinate at periphery, which is well above the median line, first half smooth, remainder covered all over with fairly strong, curved, slightly oblique transverse costulae, increasing regularly in distance apart, the intervals filled with fine, parallel microscopic striolae and the whole crossed by very close, fine, regular, microscopic grooves; suture simple, well defined. Aperture obliquely 3-lunate, labrum gradually receding in profile, columella short, concave, margin narrowly reflexed, half obscuring the very narrow umbilicus.

Diam. maj. 6.75, min. 6.0; alt. 4.8; apert. alt. 3.3, lat. 3.6 mm.

Hab. NATAL. Port Natal (type, Wahlberg); Krantzkop (Warren). Type, selected as the largest perfect specimen available, in Stuttgart Museum.

The far sharper peripheral carination is alone sufficient to separate this species from aprica, and its conical spire from the young of larger forms already described; even the type has an immature appearance and may not be fully mature, but Watson's study of the anatomy of the Krantzkop animals proves that it may not be likely to attain much larger dimensions.

He states that the penis has a continuation in form between that found in charybdis and lygaea and little or no trace of a caudal pore, but considers that it may be an aberrant member of the present sub-genus.

Trachycystis africae (A. D. Brown).

(Pl. vii, f. 5.)

Ref. List No. 266 (as planti var.).

1865. Helix africae Brown, Amer. J. Conch., i, p. 136. D.

1893. Phasis (Trachycystis) africae Brown, Pilsb., Manual, viii, p. 142, pl. xliii, f. 55-56. D.F.

1893. Phasis (Trachycystis) planti Pfr., var. africae Brown, Pilsb., Manual, ix, p. 38.

Shell of moderate size, depressed globose, umbilicate, thin, dull, transparent, corneous yellow-brown. Spire little exserted, sides straight, apex submamillate. Whorls 54, not very convex, bluntly shouldered at the periphery, which is high on the body whorl, little lower than the suture, first 1\frac{1}{4} smoothly malleate, remainder sculptured with regular, curved, oblique transverse costulae, close at first, increasing considerably in distance apart, and much weaker on the last whorl, the

interstices filled with extremely fine, close, and numerous parallel microscopic striolae and the whole crossed by exceedingly fine, faint and close microspiral lines, which appear as slightly undulating coarsish furrows on the base, where the transverse costulae are a little weaker; suture simple, well defined. Aperture obliquely \(\frac{3}{4}\)-lunar, not descending, peristome slightly expanded, labrum receding gradually to base, columella very short, concave, erect, margin narrowly reflexed, half covering the very narrow umbilicus.

Diam. maj. 8.8, min. 7.3; alt. 5.0; apert. alt. 4.0, lat. 4.6 mm.

Hab. CAPE PROVINCE. "Great Brakke" (E. R. Beadle).

Type in Academy of Natural Sciences, Philadelphia.

The type set of this species consists of 8 examples, and the paratype described above was most kindly lent me as being one of those in best condition, but the largest shell mentioned by Pilsbry is  $9.6 \times 6$  mm. in breadth and altitude. Brown differentiates his species from planti Pfr. in its being "smaller, more elevated, more acutely carinated, in the coarser striae and in the absence of the short hairs occurring in that species," while Pilsbry states that "the membranaceous riblets are a trifle ragged on the edges, but there are no hairs; peripheral angulation higher on whorl than in planti."

It might be conceivable to deduce from the single specimen that I have seen that it may differ from planti in the costulae on body whorl being slightly weaker and the shouldering a trifle higher than in that species, but these features are of themselves so liable to modification when a large series becomes available for examination, and the shells of planti and africae resemble one another so closely in all but one most important detail, that it would be practically impossible to separate them were it not that both Brown and Pilsbry state that africae is entirely hairless, a fact confirmed by my own examination of the shell here described, which shows trace of the spotted mantle through the shell and was apparently collected in live condition; the locality, too, Great Brak R., near Mossel Bay, is so far distant from Natal as to lend colour to its distinctness. Unless, therefore, all of the type set were originally hirsute and every hair was cleaned off in a too zealous effort to tidy them up, a case not without precedent in the annals of conchology, they can only be regarded as specifically distinct from planti, since the presence or absence of this feature, if constant, is of far more than mere varietal importance.

Trachycystis permeata M. & P. Ref. List No. 262.

1903. Trachycystis permeata M. & P., A.M.N.H., xii, p. 603, pl. xxxii, f. 2. D.F.

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1932. Trachycystis permeata M. & P., Conn., Ann. Natal Mus., vii, p. 94. N.

1934. Trachycystis permeata M. & P., Watson, Proc. Mal. Soc., xxi p. 177. N.R.

A little smaller than conica, with rather depressed spire and widely open umbilicus; the silky, corneous shell is greenish brown, with 5 convex, regularly increasing whorls, bluntly angled at the periphery, first 2 showing extremely faint microscopic spiral grooves, remainder sculptured with strong, regular, slightly curved and oblique transverse costae, the intervals between them filled with very fine parallel striolae, cut by the spiral lines, which, however, are extremely faint on the upper surface, though stronger on the base; suture simple, well defined. Aperture angularly lunate, labrum gently recurved, columella concave, simple, umbilicus deep and open.

Diam. maj. (type) 6·1, min. 5·2; alt. 3·3; apert. alt. 2·3, lat. 2·6 mm.

Hab. NATAL. Pinetown (type); Tongaat (Burnup); Isipingo (Alexander); Karkloof R. Valley (Falcon).

ZULULAND. Mfongosi (var., Jones).

Type in British Museum.

Placed in this group on account of its blunt peripheral carination, and easily distinguishable by reason of its open umbilicus. The Isipingo shells, though apparently mature, possess but 4 whorls, with a diameter of 4·1 mm., and are probably a stunted race.

A single example from Mfongosi in somewhat weathered condition is so much higher in the spire as to suggest, at first glance, a distinct species, but other features, including microsculpture, do not appear to justify separation.

The central and lateral teeth of radula somewhat resemble those of *capensis*, but in the marginals the mesocone is unusually long and ectocone and endocone extremely small, suggesting that the species is partly carnivorous.

# (b) Group of lovéni Krs.

Thin, depressed, *hirsute* shells of moderately large dimensions; Watson places *clifdeni* Conn. in *Chilocystis* and suggests that others of this group probably belong there.

Trachycystis lovéni (Krs.).
(Pl. vii, f. 10.)

Ref. List Nos. 254 and 266.

1848. *Helix lovéni* Krs., Südafr. Moll., p. 76, pl. iv, f. 21. *D.F.* 1854. , *platti* Pfr., P.Z.S., p. 51. *D*.

,, , , , planti Pfr., Rve., Conch. Icon., pl. clxxxix, f. 1325. D.F.

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1922.  $Trachycystis\ planti$  Pfr., Conn., Proc. Mal. Soc., xv, p. 73. N. 1932. ,,  $lov\acute{e}ni$  Krs. (= planti Pfr.), Conn., Ann. Natal Mus., vii, p. 92. N.

Shell of moderate size, depressed subconic, narrowly umbilicate, thin, transparent, dull, hirsute, pale corneous. Spire moderately exserted, apex mamillate. Whorls 6, regularly increasing, each projecting clearly above the next, convex, bluntly shouldered at periphery, protoconch,  $1\frac{1}{4}$  whorl, smooth, remainder sculptured with very slightly curved and oblique, rather distant, regular, strong, rather broad costae, gradually becoming farther apart, the intervals closely packed with extremely fine, faint, microscopic parallel striolae, crossed by stronger, close, regular, slightly undulating spiral lines; basal sculpture similar, the costae converging into the umbilicus; about the peripheral region each of these bears from 1 to 4 spiny bristles, straight or slightly curved and pointing in irregular directions; suture simple, well defined. Aperture obliquely  $\frac{3}{4}$ -lunate, descending considerably at the base, peristome very slightly expanded in maturity, labrum straight and hardly receding in profile, columella concave, margin narrowly expanded, scarcely overhanging the narrow umbilicus.

Diam. maj. 9.6, min. 8.4; alt. 6.4; apert. alt. 4.7, lat. 5.0 mm.

Hab. NATAL (*lovéni*, Wahlberg; *planti*, Plant); common at Durban and distributed elsewhere over the province.

ZULULAND. Umbonambi (Burnup).

TRANSVAAL. Lydenburg (Craven); Shilwane District (Junod). CAPE PROVINCE. Tharfield, near Kleinemonde R., Bathurst Dist. (Miss Bowker, fide Layard).

Type of *lovéni* in Stuttgart, *planti* in British Museum; recent comparison of both types leaves no doubt as to their synonymy.

Shell described, from Durban, in my collection.

# Trachycystis calorama M. & P. Ref. List No. 235.

1899. Trachycystis calorama M. & P., A.M.N.H., iv, p. 196, pl. iii, f. 6. D.F.

Very nearly akin to the last, from which it may differ in the umbilicus being still narrower, the costae a little weaker and the intermediate striolae a little stronger.

Diam. maj. 9.4, min. 8.2; alt. 6.0; apert. alt. 4.4, lat. 4.8 mm.

Hab. NATAL. Pinetown (type) and Inchanga (Burnup).

Type in British Museum.

Description from a topotype in my collection.

#### Trachycystis actinotricha (M. & P.). Ref. List No. 227.

1892. *Helix* (*Pella*) actinotricha M. & P., A.M.N.H., x, p. 238, pl. xiii, f. 5. *D.F.* 

Smaller than either of the foregoing, with umbilicus and sculpture similar to that of *lovéni*; the bristles on the later whorls are arranged in 2 regular, parallel spiral rows. There are 5 flattish whorls and the shell measures

Diam. maj. 8·2, min. 7·1; alt. 5·6; apert. alt. 3·8, lat. 4·3 mm.

Hab. NATAL. Pietermaritzburg (type); Karkloof; Nottingham Road (Burnup).

ZULULAND. Richards Bay (Rump).

Type in British Museum.

Description of specimen from Karkloof in my collection.

# Trachycystis trichostiroma (M. & P.).

Ref. List No. 279.

1892. *Helix* (*Pella*) trichosteiroma M. & P., A.M.N.H., ix, p. 84, pl. iv, f. 9. D.F.

1893. Helix (Pella) strobilodes M. & P., A.M.N.H., xi, p. 19, pl. iii, f. 1. D.F.

Smaller than the last three, with 6 whorls, slightly less shouldered at the periphery; the umbilicus is as in *lovéni* and the sculpture that of the three, but the bristles occur plentifully, though somewhat irregularly, along the entire length of the costae until nearing the umbilicus.

Diam. maj. 6.8, min. 6.4; alt. 4.3; apert. alt. 2.5, lat. 3.4 mm.

Hab. CAPE PROVINCE. Port Elizabeth (type, fide M. & P.); Tharfield (Miss Bowker); Amabele Junction (Puzey); *strobilodes* was described from "Cape Colony."

Both types in British Museum.

# Trachycystis conisalea (M. & P.).

Ref. List No. 238.

1892. Helix (Pella) conisalea M. & P., A.M.N.H., x, p. 239, pl. xiii, f. 7. D.F.

1934. Trachycystis conisalea M. & P., Watson, Proc. Mal. Soc., xxi, p. 177. N.A.

A small, subglobose, narrowly rimate shell, with similar, but for much weaker spiral, sculpture to all the foregoing; the short, very fine bristles extend all along the costae, being arranged in about 15 parallel spiral lines; the 5 convex whorls are shouldered below the suture, causing it to be deeply impressed.

Diam. maj. 6.4, min. 5.8; alt. 4.9; apert. alt. 3.4, lat. 3.2 mm.

Hab. NATAL. Pietermaritzburg (type); Nottingham Road; Karkloof; Dargle; Equeefa; Table Mountain, east of Maritzburg (Burnup); Bulwer (Warren).

Type in British Museum.

Description from topotype in my collection.

Watson states that the foot of this species lacks a caudal mucous pore and that it seems to belong to a separate group intermediate between *Chalcocystis* and *Chilocystis*; its hairy periostracum, however, decides me to place it for the present, for easy reference, in the group now under notice.

Trachycystis pycnotricha M. & P.

Ref. List No. 268.

1899. Trachycystis pycnotricha M. & P., A.M.N.H., iv, p. 197, pl. iii, f. 7. D.F.

Agrees with trichostiroma in shape, size, and carination, but has rather less closely coiled whorls and less narrow umbilicus. The  $5\frac{1}{4}$  whorls are moderately convex, first  $1\frac{1}{4}$  smooth, after which the sculpture is similar to that of trichostiroma, but the transverse costulae are closer and stronger, developing into peripheral flanges, each of which bears in well preserved shells a short wavy bristle, and the spiral grooves are a little weaker, and very faint on the extreme base and umbilical region.

Diam. maj. (type) 7.0, min. 6.3; alt. 4.8; apert. alt. 2.9. lat. 3.4 mm.

Hab. CAPE PROVINCE. Kowie River (type, Cox); Keurbooms River bush (Barnard).

Type in British Museum.

Trachycystis centrifuga M. & P. Ref. List No. 236.

1903. Trachycystis centrifuga M. & P., A.M.N.H., xii, p. 602, pl. xxxii, f. 9. D.F.

A silky, transparent, corneous brown shell with straight-sided, subconical spire, rather strong peripheral carination and very narrow umbilicus. There are 5 flattish, regularly increasing whorls, first  $1\frac{1}{2}$  engraved with rather coarse, close, microscopic spiral grooves, remainder with strong, sharp, regular, rather distant, curved, oblique transverse costae, gradually becoming farther apart (36 on the last  $\frac{1}{2}$ -whorl), developing short, vertical peripheral flanges, ending in a short bristle, the interstices filled with a continuation of the strong spiral apical grooving; suture simple, impressed. Aperture quadrate, upper columellar margin narrowly reflexed, but nearly half concealing the narrow umbilicus.

Diam. maj. (type) 7.8, min. 7.0; alt. 5.4; apert. alt. 3.6, lat. 3.6 mm.

Hab. CAPE PROVINCE. Maeström Forest, Bedford (type, Farquhar); Knysna Forest (Barnard); Pirie Forest (var., Godfrey); Hogs Back, Amatola Mts. (Smith).

Type in British Museum.

Closely allied to the foregoing species, as might be expected from their geographical distribution.

#### Trachycystis knysnaensis Prest.

Ref. List No. 250.

1912. Trachycystis knysnaensis Prest., Proc. Mal. Soc., x, p. 17. D.F.

Founded on a series of small examples, probably less than half-mature; they resemble centrifuga in all respects except that the sculpture is rather weaker and the sides of the spire infinitesimally convex, rendering it improbable that they are the young of that species. Preston's measurements of the type are

Diam. maj. 4.5, min. 4.0; alt. 2.5; apert. alt. 1.75, lat. 1.75 mm.

Hab. CAPE PROVINCE. Knysna Forest (Cox). Type in coll. Dautzenberg.

#### Trachycystis alcocki (M. & P.). Ref. List No. 229.

1895. Helix (Trachycystis) alcocki M. & P., A.M.N.H., xv, p. 164, pl. xii, f. 2. D.F.

Differs from the Natal group in the peripheral carination, though blunt, being more prominent and the aperture not descending at the base. There are 6 convex, gradually increasing whorls, with usual pattern of sculpture, but the costae rather weaker; the bristles, of varying length, are arranged in a dozen or more fairly regular spiral lines, but appear to be absent from the region of the narrow umbilicus. Diam. maj. 8·6, min. 8·1; alt. 5·3; apert. alt. 3·2, lat. 4·0 mm.

Hab. CAPE PROVINCE. Kowie (type); Port Alfred to Alexandria District (Crawford); Grahamstown (Farquhar).

Type in British Museum.

Description of example from Grahamstown in my collection.

#### Trachycystis cressyi Conn.

1925. Trachycystis cressyi Conn., Trans. R. Soc. S. Africa, xii, p. 142, pl. iv, f. 11. D.F.

A small, narrowly umbilicate shell, with 4 convex, regularly increasing whorls, shouldered at the periphery, which is situate well above the median line; the sculpture is as usual in the group, with strong ribbing, and the curved, deciduous bristles extend along the costulae from near the suture to the base in about 10 parallel spiral lines, but are only retained in extremely fresh specimens; columella weak and concave, margin narrowly reflexed, leaving open the narrow umbilicus.

Diam. maj. (type) 5·1, min. 4·5; alt. 3·5; apert. alt. 2·2, lat. 2·5 mm.

Hab. LORENZO MARQUES. District north of Macequece (type, Cressy).

S. RHODESIA. Six miles from Penhalonga (Miss Grey). Type in British Museum.

#### Trachycystis clifdeni Conn.

1932. Trachycystis clifdeni Conn., Ann. Natal Mus., vii, p. 93, pl. v, f. 12. D.F.

1934. Trachycystis clifdeni Conn., Watson, Proc. Mal. Soc., xxi, p. 175. N.

Shell of fair size, inverse flabelliform, silky, hirsute, pale corneous brown. Spire little exserted, apex narrowly mamillate. Whorls 5, almost flat above, sharply angled at periphery and inflated beneath, the 1st practically smooth, 2nd showing very faint, close transverse striae, which increase rapidly in strength and distance apart, developing on the 3rd into strong, curved, oblique costulae, each bearing on the angle of the periphery a long, thin, horny spine, the intervals filled with extremely close microscopic striolae and the whole cut by equally close, regular, slightly undulating microspiral grooves; basal sculpture similar but costulae rather weaker; suture shallow. Aperture obliquely quadrate, descending at base, labrum very gradually receding, columella short, weak, concave, margin scarcely reflexed, not overhanging the very narrow umbilicus.

Diam. maj. 8.5, min. 7.7; alt. 5.1; apert. alt. 3.7, lat. 5.7 mm.

The largest specimen to hand is 8.7 mm. in diameter.

Hab. ZULULAND. Eshowe (Burnup).

Type in British Museum.

The shape of this shell, which resembles an inverted fan or some kinds of teetotum, distinguishes it from all its hirsute allies; it bears much resemblance to *T. placenta*, of the group which follows, but is higher in proportion, with less-pronounced carination, while *placenta* is devoid of hirsute ornamentation. The type, though in brilliant condition, has a smooth protoconch apparently devoid of microspiral sculpture, which, however, is discernible in a younger example and is evidently a soon evanescent feature in this species.

Trachycystis watsoni, sp. n.

(Pl. vii, f. 11.)

1934. Trachycystis sp., Watson, Proc. Mal. Soc., xxi, p. 175. N.

Much resembles the foregoing in general form, colour, and texture, but is larger, with far blunter peripheral angulation and many spiral lines of bristles and spines, whereas there appears to be but a single one in clifdeni.  $5\frac{3}{4}$  whorls, rather strongly shouldered at periphery, which is well above median line, first  $1\frac{1}{2}$  practically smooth, remainder sculptured with curved, oblique, transverse riblets, gradually increasing in strength and distance apart, the interstices filled with very fine and close parallel striolae and the whole more or less cut by fine microspiral grooves, very faint until the last  $2\frac{1}{2}$  whorls; the transverse riblets after the earliest whorls, according to condition, since they are extremely deciduous, bear spiral rows of hairy spines, very short, when still present, near the suture, but very long just above the shoulder and continuing with gradually diminishing length for about 6 rows below it in very fresh shells and reappearing in the umbilical region; the long peripheral hairs have a peculiar and characteristic form, in that they are

flattened out rather broadly, as it were, for the greater part of their length, and then change suddenly to a long sharp point somewhat near their tip; suture well defined. Aperture obliquely \(\frac{3}{4}\)-lunate, labrum receding a little in profile, peristome simple in type but inclined to expand slightly in maturity, umbilicus extremely narrow, margin scarcely reflexed.

Diam. maj. 9.9, min. 8.6; alt. 6.5; apert. alt. 4.9, lat. 5.3 mm.

Hab. NATAL. Krantz Kop (type); Zimbaba (Burnup). Type in British Museum.

I have great pleasure in naming this fine species after Hugh Watson, whose recent work on the present genus is of such inestimable value; the type is not quite mature, but is selected as having retained its bristles better than any other shells that have been available for examination; the anatomy of both this and the last species agrees with that of Chilocystis.

### (c) Group of scolopendra M. & P.

Epidermis developing leaf-like laminae at periphery.

#### Trachycystis scolopendra M. & P. Ref. List No. 273.

1903. Trachycystis scolopendra M. & P., A.M.N.H., xii, p. 603, pl. xxxii, f. 3. D.F.

1934. Trachycystis scolopendra M. & P., Watson, Proc. Mal. Soc., xxi, p. 175. N.

Shell comparatively large, discoid, umbilicate, thin, asperate, pale corneous brown. Spire depressed, apex mamillate. Whorls 6, nearly flat, acutely carinate at periphery, regularly increasing, first 12 smooth, remainder covered all over with sharp, curved, oblique transverse costae, increasing in strength and distance apart on each succeeding whorl, the intervals filled with microscopic transverse striolae, increasing in number with the widening of the intervals, cut by close, strong, regular, spiral lines; the costae are prolonged beyond the edge of the periphery into prominent, round, horizontal laminae; suture well defined, crossed irregularly by some of the laminae absorbed on the early whorls. Aperture subrhombic, slightly descending, peristome tending to expansion in mature shells, columella weak, concave, margin narrowly reflexed, not overhanging the umbilicus, which is not wide but deep and open, exposing all the whorls.

Diam. maj. 13.5, min. 11.3; alt. 7.2; apert. alt. 5.1, lat. 6.6 mm.

Hab. NATAL. Port Shepstone (type); Equeefa; Durban; Lower Umkomaas (Burnup); Umzimkulu (Purcell).

CAPE PROVINCE. Port St. John's (Shortridge); Pirie (Godfrey). Type in British Museum.

Description from topotype in my collection.

A most beautiful species, whose laminar fringe renders it unique among South African molluses.

(xvii) Group of placenta M. & P.

Containing two extremely delicate species, originally attributed to *Trochomorpha* and *Zingis*. While their generic position is doubtful, it is convenient to unite them in a group near *clifdeni*, which they resemble in nearly all respects except for having a smooth epidermis, free from hirsute ornamentation.

Trachycystis placenta (M. & P.). Ref. List No. 152.

1899. Trochomorpha placenta M. & P., A.M.N.H., iv, p. 197, pl. iii, f. 9. D.F.

1932. Trachycystis placenta M. & P., Conn., Ann. Natal Mus., vii, p. 93. N.

Shell of fair size, narrowly rhomboid, umbilicate, thin, fragile, silky, transparent, pale corneous brown. Spire but little exserted, sides straight, apex mamillate. Whorls 5, rather rapidly increasing, nearly flat above, strongly carinate at the periphery and but little inflated beneath, first  $1\frac{1}{2}$  smooth, remainder sculptured all over with coarse, regular, curved oblique striae, the intervals packed with extremely faint, fine, parallel, microscopic striolae, the whole cut, especially on the last 2 whorls and base, by very close, regular, microscopic spiral lines; suture simple, well defined. Aperture subquadrate, peristome simple, acute, labrum nearly straight and only receding very slightly in profile, columella short, erect, concave, margin scarcely expanded, not overhanging the narrow umbilious.

Diam. maj. (type) 11·2, min. 9·3; alt. 4·8; apert. alt. 4·0, lat. 5·7 mm.

Hab. ZULULAND. 'Nkandhla Forest (Haygarth). Type in British Museum.

Trachycystis haygarthi (M. & P.). Ref. List No. 138.

1899. Zingis haygarthi M. & P., A.M.N.H., iv, p. 195, pl. iii, f. 3. D.F.

Shell of fair size, inversely flabelliform, narrowly rimate, thin, fragile, transparent, milky olivaceous, with a faint, narrow band of pale chestnut just above the periphery. Spire but little exserted, sides straight, apex submamillate. Whorls  $4\frac{1}{4}$ , regularly increasing, not very convex above, much inflated beneath, with a strong projecting keel at the periphery, first  $1\frac{1}{2}$  nearly smooth, remainder sculptured much as in placenta, the microscopic striolae being weaker and the spiral grooves stronger; suture simple, well defined. Aperture  $\frac{3}{4}$ -lunate, sharply angulate at periphery, peristome simple, acute, labrum straight and gradually receding in profile, columella short, erect, upper margin extremely shortly and narrowly reflexed over the minute rima.

Diam. maj. (type) 10·5, min. 8·0; alt. 6·8; apert. alt. 6·1, lat. 6·2 mm.

Hab. ZULULAND. 'Nkandhla Forest (Haygarth). Type in British Museum.

Genus Afropunctum Haas, 1934 (Zool. Anz. Leipzig, evii, p. 221). Type A. mermodi Haas.

Shell depressed globose, narrowly umbilicate, fairly solid, obviously calcined, little transparent, grey-brown above with several large irregular pale patches, pale greyish yellow beneath; with regard to these patches it must be borne in mind that they are perhaps due to preservation in alcohol and not a specific feature. The genotype is very finely transversely hair-striate above, without spiral sculpture. but exhibits fine microscopic network beneath, formed by the crossing of spiral and transverse grooves (after Haas).

It may be advisable to place this genus here, rather than in the Punctinae, until the anatomy is known.

> Afropunctum quadrisculptum sp. n. (Pl. vii, f. 15-17.)

Shell very small, turbinate, umbilicate, much weathered, whence rather solid and opaque, buff with numerous white patches apparently due to weathering. Spire moderately exserted, apex bluntly rounded. Whorls 31, convex, with faintest symptom of blunt peripheral angulation, sculpture of first 2 undecipherable, remainder covered above with very close, fine and crisp transverse microscopic striae cut by equally close and fine microspiral grooves, basal sculpture similar, but both types of striation a little wider apart, forming the network stressed in Haas' species; suture simple. Aperture oblique 3-lunate, not descending, columella concave, margin very narrowly reflexed, but practically obscuring the minute umbilicus.

Diam. maj. 2·1, alt. 1·4 mm.

Hab. S. RHODESIA. Mrewa (Blackie).

Type in British Museum.

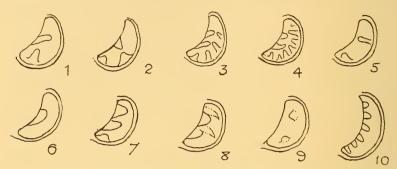
Owing to its poor condition I had not intended to deal with this little shell, until the publication of Haas' paper cited above brought to my notice the fact that it is obviously a second member of his new genus, differing from the genotype in nothing but distinctly narrower umbilicus and the presence of strong spiral sculpture on the upper surface.

> Genus Afrodonta M. & P., 1908 (A.M.N.H., i, pp. 133, 135). Type A. bilamellaris M. & P.

Shell minute, corneous, flattish, deeply umbilicate, 4-5 tumid, slowly increasing whorls, sculptured with radial costulae or striae and bearing in the aperture or interior a varying number of teeth

or folds; columella without marginal reflexion; animal with peripodial groove but no caudal gland, central and lateral teeth tricuspid, marginals with several minute, irregular denticles.

It would be indeed difficult to distinguish between these microscopic forms were it not that they differ clearly in number and arrangement



Text-fig. 19.—Apertural dentition of South African Afrodontidae, highly magnified.

1. A. bilamellaris M. & P., two processes, one on parietal wall and one on base. 2. A. trilamellaris M. & P., three processes, one on paries, one on base, and one on labrum. 3. A. farquhari Bnp., six processes, two on paries, one on base, and three on labrum. 4. A. novemlamellaris Bnp., nine processes or more, two on paries, one on base, and from six to eight on outer wall. 5. A. inhluzaniensis Bnp., two processes, one on base and one on labrum. 6. A. unilamellaris Conn., one process on paries. 7. A. burnupi Conn., three processes, two on paries and an obscure tubercle on base. 8. A. acinaces Conn., four processes, two on paries and two, inrunning, on labrum. 9. A. introtuberculata Conn., two small deep-set tubercles within outer wall. 10. A. bimunita Conn., about twelve processes, formed in two vertical rows, one inset behind the other, of six minute denticles on parietal wall.

of plical processes; in order, therefore, to portray these features as simply as possible I present rough diagrams showing their disposition in each species: I deal with them hereunder in order according to the number of processes.

# A. Dentition apertural.

 $A frodonta\ unilam ellar is\ {\tt Conn.}$ 

(Text-fig. 19, 6.)

1933. Afrodonta unilamellaris Conn., Ann. Natal Mus., vii, p. 146, pl. vii, f. 2–4. D.F.

Shell discoid, silky, corneous brown; spire nearly flat. Whorls 4, convex, first 1½ practically smooth, remainder sculptured all over with extremely close and fine transverse microscopic striae, which are crossed by equally close microspiral lines; suture impressed. Aperture lunate, dentition consisting of a single,

strong, blunt inrunning plait about the centre of the paries, columella concave, umbilicus not very wide, extending to the summit and just exposing all the whorls. Diam. maj. 1.4 mm.

Hab. ZULULAND. Mfongosi (Jones).

Type in British Museum.

In one example of the type series the parietal lamella is divided into two, a feature not uncommon in the next species.

#### Afrodonta bilamellaris M. & P.

(Text-fig. 19, 1.)

Ref. List No. 211.

1908. Afrodonta bilamellaris M. & P., A.M.N.H., i, p. 134, pl. vii, f. 6. D.F.

1908. Afrodonta bilamellaris M. & P., G.-Aust., ibid., p. 135, pl. viii, f. 2. A.R.

Shell depressed globose, silky, corneous brown; spire little exserted. Whorls 5, nearly flat, 1st smooth, remainder with extremely close and fine radial striolae. Aperture lunar, dental processes 2, a strong mid-parietal fold and an acute mid-basal tooth, umbilicus rather narrow, subfunicular. The type measures  $1.48 \times 0.84$  mm. in altitude and diameter.

Hab. NATAL. Dargle (type); Edendale; Tongaat; Enon Bush, Richmond; Hilton Road; Ntimbankulu (Burnup); Sinkwazi (Pennington); Winkle Spruit (Akerman).

CAPE PROVINCE. Keurbooms R. bush, Plettenberg Bay (Barnard).

Type in British Museum.

Burnup mentions that examples from Tongaat exhibit such contortion of the parietal fold as to give it the appearance of bifidity; the radular formula given by Austen is  $(7+9+1+9+7) \times 85$ .

# Afrodonta inhluzaniensis (Bnp.).

(Text-fig. 19, 5.)

Ref. List No. 213.

1912. Endodonta (Afrodonta) inhluzaniensis Bnp., Ann. Natal Mus., ii, p. 342, pl. xxiv, f. 14–17. D.F.

Much resembles bilamellaris in form and sculpture, which is very slightly coarser; 4 whorls; aperture nearly erect, crescentic, dentition 2-fold, a strong inrunning pointed fold near the left margin of base, and another, smaller, in middle of labrum; umbilicus tubular.

Alt. 0.86, diam. maj. 1.44 mm.

Hab. NATAL. Inhluzani Mountain (type); Van Reenen (Burnup). Type in British Museum.

Easily separable from its bidentate confrères by the absence of parietal plica.

# Afrodonta burnupi Conn.

(Text-fig. 19, 7.)

1933. Afrodonta burnupi Conn., Ann. Natal Mus., vii, p. 148, pl. vii, f. 9-11. D.F.

Shell discoid, silky, corneous brown, spire nearly flat. Whorls 4, convex, lst smooth, remainder sculptured with close, straight, regular, transverse costulae and traces on the base of extremely fine microspiral lines. Aperture semilunar, dentition 2- to 3-fold, 2 rather deep-set parietal plicae, one just above and the other just below the centre, and a rather indistinct basal tubercle, sometimes lacking, adjacent to the columella; umbilicus wide and open, extending to the summit and exposing all the whorls.

Diam. maj. 1.3 mm.

Hab. NATAL. Mkolombe Mts. (type); Tugela Estate, Weenen (Thomasset).

Type in British Museum.

Readily distinguished from the last two species, irrespective of the basal tubercle, owing to the 2 main dental processes being situate on the parietal wall and none on base or labrum.

# Afrodonta trilamellaris M. & P.

(Text-fig. 19, 2.)

Ref. List No. 216.

1908. Afrodonta trilamellaris M. & P., A.M.N.H., i, p. 134, pl. vii, f. 7. D.F.

Shell discoid, silky, yellow-brown, spire flat. Whorls 4, nearly flat, first 2 smooth, remainder sculptured with close, regular, radial striae. Aperture lunate, dentition 3-fold, mid-parietal and basal folds as in *bilamellaris* and one other in centre of labrum; umbilicus widely excavated, exposing all the whorls. The type measures

Diam. 1.39, alt. 0.8 mm.

Hab. NATAL. Dargle (Burnup).

Type in British Museum.

Distinguishable at a glance from bilamellaris by the labral fold and wide-open umbilicus.

# Afrodonta acinaces Conn.

(Text-fig. 19, 8.)

1933. Afrodonta acinaces Conn., Ann. Natal Mus., vii, p. 149, pl. vii, f. 12–15. D.F.

Shell discoid, silky, corneous brown; spire flat. Whorls 5, convex, extreme apex smooth, remainder sculptured all over with close, fine, regular, straight, transverse costulae, very faint at first, but rapidly increasing in strength; suture impressed. Aperture narrowly ovate, dentition 4-fold, consisting of 2 inrunning lamellae on the inner wall, 1 at the centre and 1 half-way between that and the base, and 2 long parallel lamellae, originating some little distance within the labrum, 1 about the periphery and 1 below it, sharply pointed at first and gradually widening to a blunt base, with a narrow groove along the centre; umbilicus very wide, exposing all the whorls.

Diam. maj. 1·4 mm.

Hab. NATAL. Van Reenen (type, Burnup). LORENZO MARQUES. Mt. Vengo (Cressy).

Type in British Museum.

The peculiar formation of the labral lamellae was illustrated with the original description, their scimitar-like shape giving occasion for the specific name.

> Afrodonta farquhari (Bnp.). (Text-fig. 19, 3.) Ref. List No. 212.

1912. Endodonta (Afrodonta) farquhari Bnp., Ann. Natal Mus., ii, p. 339, pl. xxiv, f. 7–10. D.F.

Shell subdiscoidal, silky, corneous brown; spire little exserted. Whorls 4, convex, first  $1\frac{1}{2}$  smooth, remainder sculptured with extremely weak, fine, close radial striolae; suture impressed. Aperture nearly erect, broadly crescentic, dentition 6-fold; 2 acute plicae about centre of paries, a strong one towards left of base, and 3 smaller below the periphery inside outer lip; umbilicus tubular. The type measures

Diam. 1.40, alt. 0.81 mm.

Hab. CAPE PROVINCE. Grahamstown (type); Port Elizabeth; Kowie; Bathurst (Farquhar); East London (Kincaid).

Type in British Museum.

 $A frodonta\ novem la mellar is\ ({\tt Bnp.}).$ 

(Text-figs. 19, 4; 20.)

Ref. List No. 214.

1912. Endodonta (Afrodonta) novemlamellaris Bnp., Ann. Natal Mus., ii, p. 341, pl. xxiv, f. 11-13. D.F.

1925. Endodonta (Afrodonta) novemlamellaris Bnp., Conn., Trans. R. Soc. S. Africa, xii, p. 139. N.A.R.

1933. Afrodonta novemlamellaris Bnp., Conn., Ann. Natal Mus., vii, p. 146, pl. vii, f. 1. N.F.

Shell depressed globose, silky, yellowish-brown; spire slightly exserted. Whorls 4, convex, 1st smooth, remainder sculptured with extremely weak, fine, close radial striolae; suture impressed. Aperture nearly erect, crescentic, dentition 9- to 12-fold; 2 acute plicae about centre of paries, similar to those of farquhari; 1 large and strong, as in the same species, towards left of base, and from 6 to 8, possibly 9, denticles variously disposed along the outer wall; umbilicus narrow, tubular. The type measures

Diam. maj. 1.22, alt. 0.78 mm.

Hab. CAPE PROVINCE. Grahamstown (type); Kowie (Farquhar); Kingwilliamstown (Godfrey).

GRIQUALAND WEST. Kimberley (Gowie).

NATAL. Ntimbankulu (Burnup).

LORENZO MARQUES. Mt. Vengo, 5500 feet (Cressy).

Type in British Museum.

Burnup states that the folds are developed at an early stage of growth, and suggests that the mollusc, as it advances towards maturity, absorbs the material from the inner ends of the lamellae and adds it



Text-fig. 20.—Afrodonta novemlanellaris (Bnp.), Mount Vengo. Half row of teeth of radula;  $\times 1600$ .

on to the outer, for in extremely young examples all the processes are present, while in the adult none of them extend more than ·4 mm. from the peristome. The number of labral folds is variable; I have not yet seen specimens with fewer than 9 though the usual number is 10.

The foot of the animal has well-marked peripodial grooves. Radula (text-fig. 20) with extremely small teeth, central and laterals tricuspid, marginals somewhat pectinate, formula  $(7+8+1+8+6)\times 100$ . It is noteworthy that in Austen's figure of the radula of *A. bilamellaris* the central and laterals are depicted as of the ordinary type such as are found in *Trach. vengoensis*; in the present species they show in several features some approach to that found in the Punctinae.

# B. Dentition wholly or partly internal. Afrodonta perfida (Bnp.).

Ref. List No. 215.

1907. Trachycystis rotula M. & P., A.M.N.H., xix, p. 99, pl. vi, f. 12. D.F.

1912. Endodonta (Afrodonta) perfida (=rotula M. & P., 1907, non Hombr. & Jacq., 1854), Bnp., Ann. Natal Mus., ii, p. 337, pl. xxiv, f. 1-6. D.F.

Shell subdiscoidal, silky, reddish brown; spire nearly flat. Whorls 5, convex, first 2 smooth, remainder sculptured with fairly close, strong, regular, radial costulae; suture impressed. Aperture nearly erect, crescentic, dentition 3-fold: a strong, wide fold on the parietal wall, deep-set within the aperture, strengthening to the rear; 1 on the basal wall, set back about one-fifth of the last whorl from the peristome and entering for about one-fourth of the whorl, and 1 low on the outer wall, parallel and nearly equal in length to the basal, both these folds showing clearly as white lines through the base of the shell; umbilicus very wide, openly exposing all the whorls.

Diam. 1.8-1.95, alt. 0.85-0.95 mm.

Hab. CAPE PROVINCE. Fern Kloof, Grahamstown (Farquhar). Type in British Museum.

The correct name of this species is open to question; M. & P. named it rotula, under the impression that Afrodonta was a distinct genus, while Burnup, treating the last as a subgenus of Endodonta, amended it to perfida, owing to rotula being preoccupied in the latter genus. Now that it appears possible to regard Afrodonta once again as of generic rank, it may be urged that rotula should hold good, but there can be no useful purpose in changing continually the name of a species while there is liable to be divergence of opinion as to its true generic or subgeneric status, and as the next author who may deal with the matter may once more subjugate Afrodonta to Endodonta, it is surely preferable to retain Burnup's name, as to the validity of which there can be no doubt, than to see-saw between the two.

# Afrodonta introtuberculata Conn.

(Text-fig. 19, 9.)

1933. Afrodonta introtuberculata Conn., Ann. Natal Mus., vii, p. 147, pl. vii, f. 5–8.  $\,D.F.$ 

Shell discoid, silky, red-brown; spire somewhat impressed. Whorls  $5\frac{1}{4}$ , convex, first  $1\frac{1}{2}$  practically smooth, last 3 sculptured all over with strong, close, nearly straight transverse costulae, the interstices filled with 3 or 4 extremely fine parallel microscopic striolae, which are present on the 2nd whorl a little before the costulae commence; suture impressed. Aperture lunate, descending slightly at

base, dentition consisting of 2 small tubercles, deep-set within the aperture, one near the base and the other at periphery of outer wall, and a similar pair about half a whorl further in, visible only in the form of two minute white specks on the outer surface of the shell; umbilicus wide and deep, clearly exposing all the whorls. The type measures 1.75 mm. in diameter, it is infinitesimally smaller than the largest examples, but was selected as the only one in which the 1st pair of tubercles were clearly visible from a frontal view and the 2nd pair so clearly on the exterior.

Hab. NATAL. Nottingham Road (Taynton).

Type in British Museum.

It is usually only possible to determine the two foregoing species when the shell is in sufficiently good condition for the white reflections of the interior folds to be seen on the exterior, but they, with all others of the genus, are distinguishable from small *Trachycystis* of about the same size by the tighter coiling of the whorls.

# Afrodonta bimunita sp. n. (Pl. vi, f. 1–4 and text-fig. 19, 10.)

Shell extremely small, discoid, umbilicate, thin, silky, semi-transparent, first  $1\frac{3}{4}$  whorl leaden, remainder corneous red-brown. Spire deeply impressed, nearly as much as umbilicus. Whorls  $5\frac{1}{2}$ , convex, regularly increasing, 1st comparatively large, first  $1\frac{3}{4}$  smooth, remainder sculptured all over with close, fine, regular, straight radial costulae, crossed, just within the umbilicus, by exceedingly fine, close microspiral lines; suture simple, somewhat impressed. Aperture vertical, narrowly lunate, peristome simple, acute, dentition consisting of two transverse rows, each containing 6 short, low, horizontal plicae, extending across the body whorl from the base nearly to the suture, the outer inset on outer whorl barely visible within the aperture and the inner parallel to it, and further inset by the same distance as the length of the central plicae, which show clearly as white lines on the exterior of the shell; umbilicus deep and wide, exposing all the whorls and the large leaden apex.

Diam. maj. 1.85, min. 1.75; alt. 1.04 mm.

Hab. CAPE PROVINCE. Hogsback, Amatola Mts. (Lawrence). Type in South African Museum.

Completely different from any known African shell in the double transverse row of plicae and planorbiform concavity of upper and lower sides.

Since writing my recent paper in which I restored Afrodonta to generic rank, I have had the privilege of meeting Dr. C. Montague Cooke, one of the foremost authorities on the microdentate Endodonts of the Pacific Islands. He not only agrees with me that there is good cause for treating Afrodonta as a distinct genus, but suggested, on casual examination, that it might become necessary to create one or more sub-genera for such as perfida and introtuberculata.

#### Subfamily Punctinae

Comprises the genera Punctum and the Australasian Laoma, very small shells with a peculiar type of jaw described hereunder.

> Genus Punctum Morse, 1864 (J. Portland Soc., i, pp. 5, 27).

Type H. minutissima Lea (pygmaea Drap.).

Shell minute, with simple peristome, few whorls, slightly convex spire and open umbilicus. Jaw strongly arcuate, consisting of a thin transparent membrane bearing numerous separate rhomboidal plates, composed of vertical chitinous fibres, which form a marginal fringe; radula long and narrow, teeth distinct, not overlapping, central tricuspid, laterals bicuspid to practically the extreme margin, apart from minute accessory denticles; basal plates much longer than cusps. Distribution throughout most of the Northern Hemisphere, besides South Africa.

#### Punctum hottentotum (M. & P.). Ref. List No. 248.

1891. Helix hottentota M. & P., A.M.N.H., viii, p. 239. D.

ix, p. 94, pl. iv, f. 6. F. 1892.

1907. Trachycystis paula M. & P., A.M.N.H., xix, p. 99, pl. vi, f. 11. D.F.

1925. Punctum hottentotum M. & P., Conn., Trans. R. Soc. S. Africa, xii, p. 149. N.A.R.

Shell minute, umbilicate, subglobose, thin, asperate, semi-transparent, pale corneous brown. Spire moderately exserted, apex rounded. Whorls 4, convex, rounded at periphery, regularly increasing, first 1½ practically smooth, remainder sculptured with strongly curved oblique costulae, regularly increasing in distance apart, the intervals filled with extremely fine, close, microscopic parallel striolae, cut by finer and closer microspiral lines, which commence after the 1st half-whorl and become far stronger on the base, where the transverse sculpture is weaker; suture simple, impressed. Aperture  $\frac{3}{4}$ -lunar, labrum straight and receding little in profile, columella concave, margin narrowly reflexed, not overhanging the wide, deep, open umbilicus.

Diam. maj. (type) 2.0, min. 1.75; alt. circa 1.2 mm.

Hab. CAPE PROVINCE. Port Elizabeth (type, Crawford), also known from Cathcart, Caledon, Alexandria District, Atherstone, East London, Keurbooms R. bush, Amatola Mts. etc.

CAPE PENINSULA. Wynberg; Simonstown; Lakeside etc.

NATAL. Pietermaritzburg; Majuba; Game Pass; Jesmond, Belle Vue, Upper Mooi R.; Van Reenen etc.

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TRANSVAAL. Pretoria; Buiskop; Pienaars Poort; Johannesburg (type of paula).

BECHUANALAND. Tlapies Laagte Well, west of Vryburg (subfossil, Rogers).

LORENZO MARQUES. Bandula Siding, B. & M. Rly. (McDowell). Types in British Muesum.

The costae vary greatly in strength, being in some cases hardly noticeable, when the surface merely appears to be striate; the largest examples from Lakeside measure 2.3 mm. in diameter.

The foot has well-marked peripodial grooves; jaw as in the subfamily; radula measures  $\cdot 625 \times \cdot 125$  mm. when flattened out, formula  $(15+1+15) \times 105$  (another specimen measures  $\cdot 525 \times \cdot 115$  mm., formula  $(14+1+14) \times 94$ ); central tooth tricuspid, rather narrow, with oblong basal plate, mesocone less than half the length of the basal plates and its ectocones extremely small; lateral teeth not so narrow as central, mesocones about half the length of the basal plates, ectocones scarcely exceeding half the size of the mesocones. In addition to these two principal cusps each lateral has an exceedingly minute endocone.

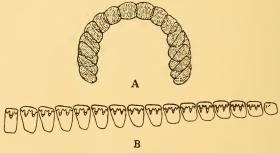
Punctum pallidum Conn.

(Pl. ix, f. 9-10, and text-fig. 21.)

1922. Punctum pallidum Conn., A.M.N.H., x, p. 119. D.

1925. ,, ,, ,, Trans. R. Soc. S. Africa, xii, p. 151, pl. iv, f. 17. N.F.R.

Far smaller than the foregoing, nearly colourless, with a more exserted spire. There are 4 convex whorls, protoconch with microscopic spiral striae, remainder



Text-fig. 21.—Punctum pallidum Conn., Vengo Mountain. A Jaw; ×300.

B. Half of a transverse row of teeth from the radula;  $\times 1600$ .

covered with fine, slightly oblique, microscopic transverse striae, about 0.03 mm. apart on last whorl, interspersed with finer ones, which are crossed by fine spiral

striae, best developed near the umbilicus; suture shallow. Aperture lunate, umbilicus not wide, but extending to the summit and just exposing all the whorls Diam. maj. 1.2, min. 1.1; alt. 0.4 mm.

Hab. LORENZO MARQUES. Mount Vengo, 5500 feet (Cressy). Type in British Museum.

Jaw (text-fig. 21A) horse-shoe shaped, composed of about 18 thin imbricating plates, which appear to have a fibrous structure; they are larger and overlap one another more towards the ends than in the centre. Radula (text-fig. 21B) measures  $\cdot 32 \times \cdot 08$  mm. when flattened out, formula  $15+1+15\times85$ ; the teeth resemble somewhat closely those of the genotype.

#### FAMILY CORILLIDAE.

Shell widely perforate, spire flat or little raised, aperture oblique, peristome expanded and reflexed, usually continuous and bearing an inrunning parietal lamella and some palatal plicae.

Jaw thin, smooth or with divergent grooves; kidney broad, without closed ureter, genitalia with spermatophore sac on or near receptacular duct, penis without appendage.

> Genus Sculptaria Pfr., 1855 (Mal. Blätt., ii, p. 135). Type Helicodonta sculpturata Gray. (Text-fig. 22.)

Shell small, solid, discoid or turbinate, umbilicate, usually strongly sculptured, last whorl deflected and free near the aperture, which

has a continuous peristome with an inrunning parietal lamella and 2 or 3 palatal plicae, defined by Burnup as in the subjoined text-figure. It is probable that every species in fresh condition is pale fawn or cream, with faint rufous markings, but it is only seldom that this is observable, owing to weathering. Foot of animal with lateral grooves, jaw smooth, central tooth of radula and inner laterals unicuspid, outer laterals with outer, marginals with inner cusp also; kidney triangular, spermatophore branching from duct of receptaculum seminis, spermiduct

very long, penis with terminal retractor.

Text-fig. 22.—Apertural armature of Sculptaria.

A. Parietal lamella.

C. Central palatal plica or fold. D. Upper

(i) Sculpture consisting mainly of tranverse striae.

Sculptaria sculpturata (Gray).

Ref. List No. 226.

1838. Helicodonta sculpturata Gray, Alexander's Expedition, ii, p. 268. D.

1910. Helix (Sculptaria) sculpturata Pfr., var. rinteleni Bttg., Abh. Senckenb. Ges., xxxii, p. 437, pl. xxviii, f. 1. D.F.

1920. Sculptaria sculpturata Gray, Gude, Proc. Mal. Soc., xiv, p. 55.  $\,N\,$ 

1922. Sculptaria sculpturata Gray, var. rinteleni Bttg., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 6. N.

1923. Sculptaria sculpturata Gray (= var. rinteleni Bttg.), Bnp., Ann. Natal Mus., v, p. 7, pl. i, f. 1–13. D.F.

1930. Sculptaria sculpturata Gray, Conn., Ann. S.A. Mus., xxix, p. 282.  $\,N.$ 

Shell small, discoid, widely umbilicate, carinate at periphery, pale buff. Whorls 5, rather convex, first 2 smooth, remainder on upper surface sculptured with spiral threads, about 5 to 9 on last whorl, crossed by radiating striae, strongest between the threads, while the foliate keel of each whorl extends over the suture on to the next whorl and presents a narrow lobed fringe round the periphery in perfect specimens; basal sculpture consisting of from 7 to 15 spiral threads, radial striae stronger than above; suture canaliculate, though apparently shallow, owing to being overlapped by the keel of preceding whorl. Aperture truncate oval, peristome usually continuous and solute, armatural processes 3, a strong inrunning parietal lamella, situate a little above centre of paries, and 2 short palatal plicae, upper and basal, the central being absent; the last whorl descends in front and is strongly constricted for a short distance before the aperture.

This species varies considerably in size, height of spire, width of umbilicus, and strength and density of sculpture, though the scheme of ornamentation is constant; Burnup's measurements range from 6.22 to 8.44 mm. in major diameter and 1.88 to 3.33 in altitude; the var. *rinteleni* has been shown by that author to be too unstable for retention, as it possesses no clear-cut feature of distinction.

Hab. GREAT NAMAQUALAND. About the Great Fish River (type, Alexander); Bullspoort (Tucker); Klein Karas Mountains (Miss A. E. Hill); between Gaub and Diab Rivers (Edlinger).

NAMIB. Swakopmund (Frames).

DAMARALAND. Usakos (Barnard); Swakop River (Bradfield); Huleb, south of Usakos (var. *rinteleni*); Kurikop near Otjikango (Rintelen); Usakos; Karibib; Khan River (Frames); Karibib (var. *rinteleni*, Michaelsen); Dorst River (N. J. Smith).

Type of sculpturata in British, var. rinteleni in Senckenberg Museum.

Easily distinguishable from other species yet described owing to lack of the central palatal plica.

# Sculptaria edlingeri sp. n.\* (Pl. viii, f. 1-4.)

Five examples from the Gaub-Diab River District are smaller than *sculpturata* and remarkable in that all of them present the usual 4-fold dentition of the genus, with the basal and central palatal folds in much the same position as in *damarensis*. The sculpture varies greatly according to condition, but agrees with that of typical *sculpturata* in similar stages of weathering, as do other details of form, etc., but the smaller size of this proposed new species, combined with the 4-fold dentition, renders it imperative to treat it as distinct. All five examples are about equal in size and have the aperture fully formed and solute; the type, selected as the specimen with best preserved sculpture, measures, with 5 whorls, diam. maj. 6·1, min. 5·0, alt. 2·1 mm.

Hab. GREAT NAMAQUALAND. Between Gaub and Diab Rivers (Edlinger).

Type in Berlin Museum.

# Sculptaria damarensis (H. Ad.).

Ref. List No. 224.

1870. Helix (Corilla) damarensis H. Ad., P.Z.S., p. 379, pl. xxvii, f. 14. D.F.

1890. Sculptaria chapmanni Ancey, Bull. Soc. Mal. Fr., vii, p. 156. D.

1892. Sculptaria melvilliana (=chapmanni Ancey, non Cox) Ancey, Brit. Nat., p. 126. Emend. nom.

1920. Sculptaria damarensis H. Ad., Gude, Proc. Mal. Soc., xiv, p. 55.  $\,N.$ 

1922. Sculptaria damarensis H. Ad., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 5. N.

1923. Sculptaria damarensis H. Ad., Dgnr., Arch. f. Moll.-K., lv, p. 146, pl. vi, f. 1–10. A.R.

1923. Sculptaria damarensis H. Ad., Bnp., Ann. Natal Mus., v, p. 19, pl. i, f. 19–23. D.F.N.

1930. Sculptaria damarensis H. Ad., Conn., Ann. S.A. Mus., xxix, p. 281. N.

Shell small, discoid, widely umbilicate, bluntly keeled at periphery, yellowish brown, with darker oblique stripes, diminishing in number on last whorl, on the upper surface. Spire a little raised, sides convex, apex blunt. Whorls 6, convex,

<sup>\*</sup> I must express to Dr. Bernard Rensch of Berlin my warmest thanks for permission to include the descriptions of this and three other new forms from the Hoesch and Edlinger collections in the present volume.

the last grooved above the keel, descending rapidly near the aperture and becoming solute a short distance before it; first  $1\frac{3}{4}$  smooth, remainder sculptured with very fine, close, crisp, white transverse striae, about 215 on last whorl, and becoming very weak on base, and on upper surface a few indistinct spiral striae, not intersecting the former; suture subcanaliculate. Aperture somewhat horse-shoe shaped, peristome white, glossy, continuous, widely expanded but little thickened, armatural processes 4, a strong inrunning parietal lamella and well developed upper, central, and basal palatal plicae, all set well back from the peristome. Burnup's measurements range from  $9.77 \times 3.98$  and  $9.5 \times 4$  down to  $8.2 \times 3.0$  and  $7.8 \times 3.4$  mm. in major diameter and altitude.

Hab. DAMARALAND (type, fide H. Adams; de Vilder, 1873); Grootfontein; Gaub; Outjo (Barnard); Tsumeb (Michaelsen); Otavi Mountain (Durban Light Infantry); Swakop R. (Bradfield).

NAMIB. Walfish Bay (chapmanni, Anderson and Chapman).

Type of damarensis in British Museum, chapmanni in coll. Dautzenberg.

#### var. minor Dgnr.

1922. Sculptaria damarensis H. Ad., var minor Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 5. D.R.

1923. Sculptaria damarensis H. Ad., var. minor Dgnr., Bnp., Ann. Natal Mus., v, p. 23, pl. i, f. 24-30. D.F.

1930. Sculptaria damarensis H. Ad., var. minor Dgnr., Conn., Ann. S.A. Mus., xxix, p. 281. N.

The shell differs from type in being smaller, less elevated, somewhat more sharply keeled, the groove above it not so deep, only 5 whorls instead of  $5\frac{1}{2}$ –6, last rather less deflected and solute for shorter distance behind aperture, which is rounder and smaller, peristome more thickened and less expanded, armature rather less strongly developed. Burnup's measurements range from  $8\cdot55\times2\cdot83$  and  $7\cdot74\times3\cdot37$  down to  $7\cdot33\times3\cdot4$  and  $6\cdot7\times3$  mm. in breadth and height.

Hab. DAMARALAND. Karibib (type, Michaelsen); Swakop Valley (Frames).

Type in Hamburg Museum.

Burnup mentions one example in which the basal palatal plica is replaced by 2 minute ones close together, but which is in other respects quite normal.

Sculptaria carinifera sp. n.

(Pl. vii, f. 18–20.)

Differs from damarensis in sharp carination at periphery, stronger basal sculpture and almost complete absence of grooving. Shell of fair size, discoid, umbilicate, asperate. Spire little exserted, sides slightly convex, apex rounded. Whorls  $5\frac{1}{2}$ , gradually increasing, convex, serrate and sharply carinate at periphery, first  $1\frac{3}{4}$  practically smooth, remainder covered all over with strong, close, regular, undulating costulae, which become serrate at the periphery; there is no trace of spiral sculpture, but this may be due to weathering; suture well defined. Aperture

incomplete in all four examples available, but dentition fully formed, similar to that of damarensis.

Diam. maj. 8.6, min. 7.8; alt. 3.4 mm.

Hab. GREAT NAMAQUALAND. Naauwkloof (Hoesch).

Type in Berlin Museum

Unfortunately all the four examples collected are incomplete at the aperture and too weathered to show colour or spiral sculpture, if it was ever present, but the new species is abundantly distinct and easily recognisable by its strong, serrated peripheral carination.

#### Sculptaria leschkei Dgnr.

1922. Sculptaria leschkei Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 7, f. 2. D.F.

1923. Sculptaria leschkei Dgnr., Bnp., Ann. Natal Mus., v, p. 25, pl. ii, f. 57–61. D.F.

1930. Sculptaria leschkei Dgnr., Conn., Ann. S.A. Mus., xxix, p. 282. N.

Shell small, discoid, widely umbilicate, mummy brown on earliest whorls, fading to nearly white near aperture. Spire slightly raised, sides convex, apex rather prominent. Whorls 5, the early convex, later flatter, last prominently keeled at periphery with a spiral groove above it, and a second keel round the umbilical region; last whorl slightly deflected about  $1\frac{1}{2}$  mm. from peristome and solute for about 1 mm., first  $1\frac{1}{2}$  smooth, remainder sculptured with very fine, close, fairly regular, white transverse striae, nearly as strong and slightly undulating on base, and slightly weaker and more distant towards aperture; suture rather shallow. Aperture roundly heptagonal, peristome continuous, moderately expanded, inner and basal lips slightly reflexed, with the 4 usual armatural processes well developed, the parietal being rather thin. Measurements range from  $9.8 \times 4$  and  $8.78 \times 3.12$  down to  $7.88 \times 2.33$ ,  $7.27 \times 2.61$  and  $6.93 \times 2.47$  mm. in major diameter and altitude.

Hab. DAMARALAND. Karibib (type, Michaelsen).

NAMIB. Swakopmund (Frames).

KAOKOVELD. Warmbad; Kaoko Otavi (Barnard).

Type in Hamburg Museum.

Mainly distinguishable from damarensis by sharper peripheral and additional basal keel and stronger basal striation; the peripheral keel is tubular.

# $Sculptaria\ framesi\ Bnp.$

1923. Sculptaria framesi Bnp., Ann. Natal Mus., v, p. 41, pl. ii, f. 62-66. D.F.

1930. Sculptaria framesi Bnp., Conn., Ann. S.A. Mus., xxix, p. 281. N.

Shell small, turbinoid, deeply but comparatively narrowly umbilicate, light buff, with paler sculpture. Spire slightly raised, sides convex, apex rounded. Whorls  $4\frac{3}{4}$ , very convex, last well rounded at periphery and bearing 2 shallow spiral grooves, 1 just above and 1 just below it, scarcely forming a blunt keel between, ascending very slightly in front, then deeply deflected but scarcely solute before the aperture; first  $1\frac{3}{4}$  whorls smooth, remainder most finely, closely, irregularly transversely striate, becoming far weaker on base except in umbilical region, and stronger and more distant just before aperture; suture rather deep. Aperture large, widely crescentic, peristome free, continuous, pinkish buff, a little expanded, slightly thickened, armatural processes 4, parietal lamella less high, tortuous and entering than usual, upper palatal plica very weak and deep-set, central and basal well developed but not very large, so that the gullet is unusually free from obstruction. Burnup's measurements range from  $6.95 \times 3.7$  and  $6.44 \times 3.81$  down to  $6.28 \times 4.24$  and  $5.68 \times 3.41$  mm. in major diameter and altitude, showing that this species is very variable as regards relative height of spire.

Hab. DAMARALAND. Swakop Valley (Frames).

NAMIB. Swakopmund (K. Schmierer).

Type in British Museum.

Characterised by high spire, weak sculpture, and very slight solution of last whorl; the striae are very much closer than in damarensis.

# (ii) Sculpture strongly reticulate.Sculptaria retisculpta (Mts.).Ref. List No. 225.

1889. Helix retisculpta Mts., Nachr.-Bl. D. Mal. Ges., xxi, p. 154. D.

1920. Sculptaria retisculpta Mts., Gude, Proc. Mal. Soc., xiv, p. 55. N.

1923. Sculptaria retisculpta Mts., Bnp., Ann. Natal Mus., v, p. 29, pl. i, f. 31–40. D.F.

1930. Sculptaria retisculpta Mts., Conn., Ann. S.A. Mus., xxix, p. 282. N.

Shell small, subdiscoid, widely umbilicate, light buff behind the paler sculpture. Spire flat above penultimate whorl, apex slightly impressed. Whorls  $4\frac{1}{2}$ , last  $2\frac{1}{2}$  very convex, last becoming solute about 1 mm. from aperture, first  $1\frac{1}{4}$  smooth, remainder bearing very strong, fairly regular radial costae (about 23 to the last whorl), pitted, reticulate or nodulate, extending into the umbilicus, the interstices occupied by strong spiral threads, a little lower usually than the radial ribs, about 8 on the penultimate and 15 between suture and umbilicus on the last whorl, so that the whole surface has a coarsely reticulate appearance; suture deep, interrupted on the later whorls by the transverse ribs extending partially over the next whorl. Aperture nearly circular, much deflected, peristome continuous, not reflexed and little expanded, parietal lamella rather thin, upper, central and basal palatal plicae not strongly developed. The specimen described by Burnup measures  $6\cdot 2 \times 2\cdot 5$  mm.

Hab. DAMARALAND. Ussab (type, ex "Linnaea," fide Martens).

NAMIB. Swakopmund (Frames).

Type in Berlin Museum.

A rare and beautiful species, with far more strongly reticulate sculpture than the two which follow, and easily distinguishable from *pyramidata* by its flat spire.

#### Sculptaria corona Bnp.

1923. Sculptaria corona Bnp., Ann. Natal Mus., v, p. 34, pl. ii, f. 41-45. D.F.

1930. Sculptaria corona B<br/>np., Conn., Ann. S.A. Mus., xxix, p. 280. N.

Shell small, subdiscoid, umbilicate, light buff behind the raised sculpture. Spire gradually raised and gradate for 2½ whorls from aperture. Whorls 5, convex, first  $2\frac{1}{2}$  nearly flat and sunk slightly below the level of the next, the last 2 strongly shouldered above, the last keeled at periphery and solute just before the aperture, with a broad spiral groove above the keel; first 2 smooth, 3rd showing worn vestiges of transverse ribs and, in the outer suture, reticulate remains of a nodulous peripheral keel; on 4th and 5th the transverse ribs extend only to the top of the shoulder, where they develop in places into strong nodules, and between them is weak cancellated sculpture, caused by the intersection of very fine spiral threads and radial striolae, and below the spiral groove a second row of nodules, most of which are apparently worn off; the basal sculpture consists of 5 strong spiral threads, between which are others extremely fine, crossed by transverse ones, which are extremely fine and close for about one-third whorl behind the peristome and then become gradually stronger and more distant, and before the last whorl actually dominate the strong spirals; suture on 3rd and later whorls somewhat interrupted by the transverse ribs on one whorl abutting on to that antecedent to it. Aperture rather small, pentagonal, much deflexed, peristome continuous, white and polished, scarcely thickened, a little expanded except between suture and periphery, parietal lamella rather thin, upper, central and basal plicae rather weak, especially central, umbilicus broadly tubular, exposing the 2 apical whorls.

Diam. maj. 5.6, min. 4.6; alt. 2.4 mm.

Hab. NAMIB. Swakopmund (type, Frames); Swakop R. (R. D. Bradfield).

Type in British Museum.

Chiefly distinguishable from the foregoing by having far less noticeably reticulate sculpture.

# Sculptaria pyramidata Bnp.

1923. Sculptaria pyramidata Bnp., Ann. Natal Mus., v, p. 38, pl. ii, f. 46–56. D.F.

1930. Sculptaria pyramidata B<br/>np., Conn., Ann. S.A. Mus., xxix, p. 282.  $\,N.$ 

Shell small, turbinate, umbilicate, pale buff. Spire exserted, convex-conic, apex rounded. Whorls 5½, very convex, slightly shouldered, the last bluntly angulate at periphery, becoming solute and deflexed 1 mm. behind the peristome; 1st smooth, 2nd bearing remains of transverse ribs between suture and shoulder, gradually becoming stronger and more distant; the sculpture gradually becomes

less effaced until on the last 2 whorls it consists of strong, raised, nodulous transverse ribs of irregular strength and spacing, about 26 on last whorl, with strong spiral threads between and partly on them, about 8 on upper surface and crossed by finer radial threads; basal sculpture worn, but somewhat similar, there being about 13 spiral threads; suture deep, interrupted by the transverse ribbing. Aperture oblique, heart-shaped, peristome continuous, a little expanded, with strong parietal lamella and moderate upper, central and basal plicae, the first 2 extremely deep-set; umbilicus somewhat tubular.

Diam. maj. 5·2, min. 4·3; alt. 3·3 mm.

Hab. DAMARALAND. Usakos (type, Frames).

NAMIB. Swakopmund (Frames).

Type in British Museum.

Easily distinguishable by its pyramidal form from the two preceding species.

#### FAMILY HELICIDAE.

Shell usually globose, turbinate, or depressed, often with a thickened or reflexed peristome. Foot without fringe or caudal gland; pulmonary veins mostly converging to a single main vessel, instead of to two as in the following family (the Acavidae); kidney tongue-shaped; epiphallus present, often with a flagellum, no penial appendix; vagina often with dart-sac (sometimes paired) and mucous glands; jaw usually ribbed or folded.

### Subfamily Helicinae.

Mucous glands, when present, tubular and arising directly from the vagina.

Genus *Helix* Lin., 1758. (Syst. Nat., Ed. 10, i, pp. 645, 768). Type *H. pomatia* Lin.

Shell rather large and globose, usually with 4 or 5 brown bands. Receptacular duct branched; epiphallus with a long flagellum; dart-sac large, containing a well-developed dart with 4 longitudinal blades; mucous glands usually split into many branches; jaw thick and ribbed.

Section Cryptomphalus Agassiz, 1837 (Nouv. Mem. Soc. Helv. Sci. Nat., i, 2, p. 5). Type Helix aspersa Müll.

Shell imperforate when mature, of rapidly enlarging whorls, peristome expanded.

Helix aspersa Müll. Ref. List No. 299.

1774. Helix aspersa Müll., Verm., ii, p. 59. D.

1908. Helix (Cryptomphalus) aspersa Müll, Germ., Moll. Khroumirie, p. 150, pl. xxiv, f. 1-4. D.F. and synonymy.

1910. Helix (Cryptomphalus) aspersa Müll., Taylor, Mon. Brit. Moll., iii, p. 236, pl. xxiii (1911). D.F.A.R.

1916. Helix aspersa Müll., Conn., Ann. S.A. Mus., xiii, p. 187. N.

The synonymy of this well-known old species will be found in my Reference List; none of it bears on the introduced South African individuals or is of local interest.

Shell large, inperforate in maturity, obliquely globose, solid, dull, subtranslucent, asperate, brownish buff, usually irregularly banded and marbled with darker brown; prevalent banding 1(23)45, but all are sometimes distinct or entirely coalescent. Whorls 4-5, convex, rapidly increasing, apex smooth, remainder covered with strong transverse striae and, on the later whorls, a network of coarse irregular wrinkles, which grow gradually more pronounced and impart a shagreened appearance to the shell; suture simple. Aperture descending obliquely, sub-ovate, peristome white, glossy, narrowly reflexed, labrum straight in profile, columella erect, margin very narrowly reflexed, exposing a very narrow umbilicus in immature shells, but thickened and solid in maturity. An average Cape Town example measures

Diam. maj. 30, min. 24; alt. 27; apert. alt. 20.5, lat. 17 mm., though much

larger individuals may be found.

The radula of an average specimen from Wimbledon measures  $8.0 \times 3.5$  mm. when flattened. It has 125 rows of teeth fully developed, formula 63+1+63; the central tooth has a longish mesocone with an ectocone on each side of it; the admedians have an ectocone but no endocone; the mesocones begin to change shape at about line 28 and become bifid about line 31. Thence outwards the teeth grow smaller, with ectocone occasionally double, until, by line 50 they become irregular in shape and the outermost marginals are rudimentary.

Hab. CAPE PENINSULA. Very common; Robben Island, also common.

CAPE PROVINCE. Port Elizabeth (Crawford); East London; Mossel Bay (Power); Grahamstown (Vet. Serv. S. Africa).

GRIQUALAND WEST. Kimberley (Miss Wilman).

NATAL. Durban (Cawston).

TRANSVAAL. Johannesburg (T. Adams).

Specimens ex auct. in Copenhagen Museum.

Several sinistral specimens have been collected at Cape Town (Lightfoot), and Taylor records var. globosa Picard from the same district.

The striking colour variety which follows well deserves its varietal status, appearing to me to agree best with

var. luteola Bgt.

1864. Helix aspersa Müll., var. luteola Bgt., Mal. Algérie, i, p. 103. D.

1908. Helix aspersa Müll., var. luteola Bgt., Germ., Moll. Khroumirie, p. 154. D.

Shell unicoloured orange, without banding, strongly malleated and shagreened; peristome and columella glossy white.

Hab. NATAL. Durban (Mrs. Gordon Parkes).

Genus Theba Risso, 1826 (Hist. Nat. Eur. Mérid. iv, p. 73). (=Euparypha Hartmann, 1842). Type Helix pisana Müll.

Shell globose to lenticular, spirally grooved; bands, when present, usually split into narrow lines on a whitish ground; peristome thickened within. Dart-sac small, with a straight dart bearing 4 longitudinal blades; mucous glands long, unbranched; receptacular duct with diverticulum; flagellum sometimes absent; jaw with 2 or 3 strong ribs.

Theba pisana (Müll.). Ref. List No. 301.

1774. Helix pisana Müll., Verm., ii, p. 60. D.

1908. ,, (Euparypha) pisana Müll., Germ., Moll. Khroumirie, p. 182, pl. xxvi, f. 1–20; pl. xxvii, f. 1–20; pl. xxviii, f. 1–24; pl. xxix, f. 1–24. D.F. Synonymy.

1911–12. Helix (Euparypha) pisana Müll., Taylor, Mon. Brit. Moll., iii, p. 368, pl. xxx, f. 1–21; pl. xxxi, f. 1–21. D.F.A.R.

1916. Helix pisana Müll., Conn., Ann. S.A. Mus., xiii, p. 187. N.

Shell of fair size, perforate, subglobose, fairly solid, dull, subtranslucent, cream or white, usually encircled by more or less numerous dark bands of varied width and intensity, frequently interrupted, blotched or broken. Whorls  $5\frac{1}{2}$ –6, not very convex, rapidly increasing, apex practically smooth, varying from colourless to dark purple-brown, remainder covered with very close, slightly curved and oblique transverse striae of somewhat irregular strength, and numerous more or less closeset spiral grooves; suture simple, shallow. Aperture  $\frac{3}{4}$ -lunar, peristome acute with a distinct submarginal rib shortly within the aperture of adult shells, labrum very slightly curved and receding in profile, columella short, erect, concave, margin triangularly reflexed, half obscuring the narrow umbilicus. An average Cape Town example measures

Diam. maj. 17.0, min. 14.5; alt. 12.2; apert. alt. 9.2, lat. intern. 8.2 mm.

More than 100 varieties of this variable species are listed by Taylor, to whose magnificent work students are referred for further details, while Germain (1908) includes nearly 30 so-called species in synonymy

and a few well-defined formal varieties.

The radula described by Taylor,  $5 \times 1\frac{1}{2}$  mm., contains about 140 gently curving transverse rows of teeth which diminish gradually in size outwards, each row with about 87 teeth, central tricuspid with strong mesocone and 2 small ectocones, laterals about 16 in number and bifid, without endocone, marginals about 27, mesocone distinctly bicuspid and ectocone becoming so about the 30th row; formula  $(27+16+1+16+27)\times 140$ .

The young shell is more or less sharply keeled and is the  $H.\ cato-cyphia$  Bgt.

Hab. CAPE PENINSULA. Very common; Robben Island (coll. Walker).

CAPE PROVINCE. Stellenbosch; East London (Lightfoot); Port Elizabeth (Crawford); Somerset West; Gordon's Bay (Connolly); Kowie (Gowie); George (Vet. Serv. S. Africa); Mossel Bay (F. Watson); Uitenhage (very common).

NATAL Durban (Longstaff).

Specimens ex auct. in Copenhagen Museum.

The earliest record of this species in South Africa was in 1881, when W. G. Fairbridge took three specimens on the now demolished Gallows Hill, near Cape Town docks, since when it has spread enormously along the seaboard of the Cape Province and to some little distance inland, and is unfortunately eating some of the endemic species out of house and home. Several beautiful colour varieties exist, but I have seen none except the more ordinary as yet from South Africa, though the varr. globosior Shutt. and depressa Req. occur with the typical form at Mossel Bay.

Genus Cochlicella Fér., 1821 (Tabl. Syst., pt. 3, pp. 28, 56 (or pp. 24, 52). Type Helix conoidea Drap.

Shell more or less turriform, peristome simple; jaw with folds, right tentacular retractor on left of penis; receptacular duct unbranched. In *C. ventricosa* there is a doubled dart sac, 4 simple salivary glands, and no flagellum.

# Cochlicella ventricosa (Drap.). Ref. List No. 295 (as acuta Müll.).

1801. Bulimus ventricosus (= H. acuta Müll.), Drap., Tabl. Moll. Fr., p. 68.  $\, D. \,$ 

1805. Bulimus ventricosus Drap., Hist. Moll. Fr., p. 78, pl. iv, f. 31-32. D.F.

1872. Bulimus ventricosus Drap., Mouss., Rev. Moll. Canaries, p. 46. D.N.

1878. Bulimus ventricosus Drap., Woll., Test. Atlant., pp. 37, 204, 415, 507. N.L.

1916. Cochlicella acuta Müll., Conn., Ann. S.A. Mus., xiii, p. 186. N

Shell small, elongate turriform, rimate, semi-calcareous, smooth, rather dull, cream with irregular corneous or red-brown streaks, bands, or blotches. Spire produced, sides straight and regular, apical angle 45°, apex acute. Whorls 7½, nearly flat, gradually increasing, rounded at periphery, 1st smooth, remainder covered with nearly straight, slightly oblique growth striae of irregular strength; suture simple. Aperture suboval, peristome simple, acute, columella erect, margin triangularly reflexed over the narrow rima.

Alt. 9.5, lat.  $4\cdot 1$ ; apert. alt.  $3\cdot 0$ , lat.  $2\cdot 5$ ; last whorl  $5\cdot 0$  mm.

Hab. CAPE PENINSULA. St. James' (Connolly); Silvermines stream, Fish Hoek-Noordhoek valley (Barnard).

A South European species, also recorded from North Africa, Cape Verde Islands, and West Indies.

Originals in Vienna Museum.

So much confusion has arisen for more than a century as to the correct names to be applied to the two well-known European species which have circulated at various epochs under the names of barbara Linn., acuta Müll., ventricosa Drap., ventrosa Fér., bulimoides Moq.-Tand., etc., that even at the date of my Reference List I was misled into attributing to the present species a name which has now, I hope, been finally established as being proper to the other. It must be definitely understood that ventricosa, the South African form, is the more obese species, with apical angle of about 45°, which does not occur in the British Isles, as distinct from barbara Linn. (= acuta Müll.), the common British species, of which the apical angle does not usually exceed about 33°.

# Subfamily Bradybaeninae (= Fruticicolinae).

Mucus glands, when present, sacculate and arising from the dart-sac or its base.

Genus Bradybaena Beck, 1837 (Index Moll., p. 18). Type Helix similaris Fér.

Shell subglobose, narrowly perforate, peristome reflexed. Epiphallus without flagellum; penis thick, dart-sac club-shaped, with 2 forked mucous glands arising from its middle; duct of elliptical receptaculum seminis unbranched, fairly short and thin; central and lateral teeth of radula with clear outer cusps.

It has for some time been agreed that the well-known generic name Eulota must yield priority to Fruticicola Held, usually dated 1837, with the type H. fruticum Müll. common to both, and similaris has followed Müller's species into Held's genus. Pilsbry,\* however, has recently proved that Fruticicola cannot have been published before 1838, whereas Bradybaena dates without doubt from 1837 and must stand for similaris and cognate forms. He places Fruticicola in synonymy of Bradybaena, whereas Thiele considers each as a distinct genus, but this question does not affect the generic name of the South African importation.

# Bradybaena similaris (Fér.). Ref. List No. 294.

1821.  $Helix \, similar is \,$  Fér., Tabl. Syst., pt. 3, p. 47 (or p. 43). L. ?1850. ,, ,, Desh., Hist., i, p. 171, pl. 25B, f. 1–4; pl. 27A, f. 1–5. D.F.

1898.  $Eulota\ similaris\ Fér.$ , Wiegm., Mitt. Zool. Samml. Mus. Naturk. Berlin, i, p. 72, pl. iii, f. 4; pl. iv, f. 1. A.R.

1914. Eulota similaris Fér., Gude, Faun. India, Moll., ii, p. 200. D.N.

1916. Eulota similaris Fér., Conn., Ann. S.A. Mus., xiii, p. 185. N. The synonymy of this species, which includes addita Fér., woodiana Lea, translucens King, cestus Bs., brardiana, stimpsoni and epixantha Pfr., squalida Zglr., genulabris Mts., borbonica Desh., and arcasiana Crosse & Deb., is fully set forth in my Reference List.

Shell of moderate size, subglobose, umbilicate, thin, smooth, rather dull, transparent, corneous flesh or pale red, without fasciation on South African specimens. Whorls 5, moderately convex, somewhat rapidly increasing, apex practically smooth, remainder covered with very close, fine, straight, oblique transverse striolae, stronger and a little spaced on the later whorls, crossed by incised spiral lines which are stronger on the base; suture simple, well defined. Aperture  $\frac{3}{4}$ -lunar, peristome white and glossy, narrowly reflexed, labrum straight and slightly

<sup>\*</sup> Proc. Mal. Soc., xxi, 1934, p. 147.

receding in profile, columella very weak, margin narrowly reflexed, half obscuring the narrow umbilicus. An average Durban example measures

Diam. maj. 13·0, min. 12·0; alt. 10·1; apert. alt. 6·5, lat. 6·0 mm.

Hab. NATAL. Durban (Plant; Quekett; Puzey; Cawston).

A species of wide circumtropical distribution, probably introduced from Mauritius into Durban, where it is apparently breeding but not by any means prolific.

Type ubi?

#### FAMILY ACAVIDAE.

Shell large, ovate or heliciform; foot without fringe or caudal gland; lung short, with at least two main pulmonary veins; kidney triangular, ureter little developed; genital organs simple, except that the free oviduct is often swollen and furnished with an appendiculum; eggs usually large; jaw usually smooth or striated, radula with relatively simple, quadrate teeth.

#### Subfamily Dorcasiinae.

Shell more or less heliciform, perforate, with a thickened or reflexed peristome. Ureter merely represented by a shallow groove arising from the hooked front end of the short kidney, genital ducts without accessary appendages; vagina and penis long, atrium very short; jaw crossed by fine striae, and usually with a slight median projection.

Genus *Dorcasia* Gray, 1838 (Alexander's Expedition, ii, p. 268). Type *D. alexandri* Gray

Shell depressed or depressed globose, umbilicate, rather thin and corneous, radially striate or costate, striae more marked and regular than in *Trigonephrus*, aperture rather small, peristome reflexed but seldom thickened. Animal differing from *Trigonephrus* in the following main respects: Foot sole rather indistinctly tripartite, kidney narrower at anterior end, pedal gland tending to emerge into body-cavity, jaw rather narrow, less than 2 mm. long, radula nearly three times as long as broad, with smaller teeth, central and laterals unicuspid, marginals usually bicuspid, rarely tricuspid; receptacular duct more than twice the length of free oviduct, which is not much swollen; penis having diagonal rows of very minute papillae.

The genus, which contains possibly only three living species, may be divided into two groups according to colour scheme and peristome.

(i) Shell in freshest condition uniform corneous brown or deep buff, ends of peristome united.

# Dorcasia alexandri Gray. Ref. List No. 282.

1838. Dorcasia alexandri Gray, Alexander's Expedition, ii, p. 268. D.

1915. Dorcasia alexandri Gray, Conn., Ann. S.A. Mus., xiii, p. 167, pl. iii, f. 5. D.F.A.

1922. Dorcasia alexanderi Gray, Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 8, f. 3–5. N.A.

1926. Dorcasia alexandri Gray, Wenz, Diam.-Wüste S.-W.-A., ii, p. 156, pl. xxxix, f. 4. N.F.

1928. Dorcasia alexanderi Gray, Haas, Senckenbergiana, x, p. 93. N.L.

1930. Dorcasia alexandri Gray, Conn., Ann. S.A. Mus., xxix, p. 285. N.L.

Shell large, depressed globose, rimate, rather thin and smooth, glossy, transparent, normally bright corneous brown. Spire but little exserted, apex obtuse. Whorls 5, the later rapidly increasing, all but first  $1\frac{1}{2}$  covered with very fine and close, regular, curved transverse striae, almost disappearing on the base, last whorl swollen, nearly as high as spire, ascending slightly from the suture and descending abruptly in front, almost concealing the aperture from frontal view; suture simple, well defined. Aperture rounded ovate, peristome continuous, free, margins not thickened, but widely reflexed, though not overhanging the perforation, which is narrow, strangulate, and so eccentric that a portion of the penultimate whorl is fully disclosed.

Diam. maj. 32.6, min. 24.8; alt. 15.5; apert. alt. 11.7, lat. 13.7 mm.

Hab. GREAT NAMAQUALAND. About the Great Fish River, probably about 18° E. and 24° 20′ S. (type Alexander); Aiais, S.W. of Warmbad (Haughton).

DAMARALAND. Usab \* (fide Martens); Kurikaubmund (Rintelen); Albrechts (Davis); Okahandja; Neudamm (Michaelsen); Windhoek; Tsumeb (Barnard); Usakos (Frames); Farm Lowe (Edlinger); Kuisib Valley near Heusis (Thomsen); Otjiwarongo (in Senckenberg Museum); Khama's Highland (N. J. Smith); Donker Hoek (Bradfield).

LITTLE NAMAQUALAND. Henkries (Lightfoot).

BECHUANALAND. Reimvastmak, Molopo River; Bosman's Pile Hills, north of Aughrabies Falls; Bak River, 8 miles above junction with Orange River (Barnard).

Type in British Museum.

\* Probably the Ugab River.

This species has been divided into many varieties, all very constant according to whether the sculpture is striate or costulate, and the perforation open or strangulate; the typical form has smooth striate sculpture; the varieties are as follow:—

#### var. minor O. Bttg.

1886. Helix (Dorcasia) alexandri Pfr., var. minor, Bttg., Ber. Senckenb. Ges., p. 22, pl. ii, f. 1. D.F.

1915. Dorcasia alexandri Gray, var. minor Bttg., Conn., Ann. S.A. Mus., xiii, p. 169, pl. iii, f. 6. D.F.

1928. Dorcasia alexanderi Gray, var. minor B<br/>ttg., Haas, Senckenbergiana, x, p. 93.  $\, L. \,$ 

1930. Dorcasia alexandri Gray, var. minor Bttg., Conn., Ann. S.A. Mus., xxix, p. 286. L.

Differs from type in being smaller, with comparatively higher spire, very slightly more pronounced sculpture above, and deeper, less excentric umbilicus.

Diam. maj. 22.6, min. 18.8; alt. 13.5; apert. alt. 9.9, lat. 11.0 mm.

Hab. BECHUANALAND. Ghous (type, Nolte); Bosman's Pile Hills, north of Aughrabies Falls; Bak River, 8 miles above junction with Orange River (Barnard); Zwart Puts (Miss Wilman).

GREAT NAMAQUALAND. Geitsi-Gubib (Schenck; Rogers); Brukkaros (in Senckenberg Museum).

DAMARALAND. Windhoek (McKie).

Type in Senckenberg Museum.

Almost every intermediate between type and smaller variety can be found, so that the points of difference mentioned above are by no means constant.

#### var. rotundata Mouss.

1887. Helix alexandri Gray, var. rotundata Mouss., J. de C., xxxv, p. 292, pl. xii, f. 1. D.F.

1914. Dorcasia alexandri Gray, var. siegmanni Honigmann, Nachr.-Bl. D. Mal. Ges., lxiv, p. 29. D.F.

1915. Dorcasia alexandri Gray, var. rotundata Mouss. (= siegmanni Hngmn.), Conn., Ann. S.A. Mus., xiii, p. 169, pl. iii, f. 7; pl. iv., f. 6, 16, 24; pl. v, f. 8, 11. D.F.A.R.

1928. Dorcasia alexanderi Gray, aff. var. rotunda Mouss., Haas, Senckenbergiana, x, p. 93, and f. 1, 2 on p. 92. N.F.

Shell umbilicate, pale corneous, peristome white and glossy. Whorls  $4\frac{1}{4}$ , all but the apical sculptured with close, regular transverse costae, which become closer and finer on the base and extend into the umbilicus; last whorl descending abruptly in front; suture deep. Aperture rounded ovate, peristome quite free,

continuous, widely reflexed but in no manner overhanging the umbilicus, which is deep, but strangulate and very narrow.

Diam. maj. 21·1, min. 16·8; alt. 12·3; apert. alt. 9·2, lat. 10·8 mm.

Jaw 1.9 mm. long, rather thin, golden brown; radula  $5 \times 1.8$  mm., teeth less diverse in shape than in *coagulum* and *rogersi*, outer marginals with squarer bases, ectocones present on about  $\frac{5}{8}$ ths of the teeth, formula  $(39+1+40)\times 139$ ; another specimen has formula  $(41+1+41)\times 166$ .

Hab. GREAT NAMAQUALAND. Rehoboth (type, Schinz); Homeib River, S.W. of Rehoboth (siegmanni, Siegmann); Heliographenberg, near Rehoboth; Tsumis (subfossil, Lotz); Schwarz Modder R., Rehoboth; Kunatz; Eisgaubib (Edlinger).

Type of rotundata in Zurich Museum; paratypes of siegmanni in coll. Connolly.

The shell ranges in size from  $26.0 \times 16.5$  to  $19.0 \times 12.4$  mm. in breadth and height; similar to type and var. *minor* about the umbilical region, but with stronger, though equally close sculpture and a more exserted spire; its known distribution is confined to the neighbourhood of Rehoboth.

#### var. trivia O. Bttg.

1910. Dorcasia alexanderi Gray, var. trivia Bttg., Abh. Senckenb. Ges., xxxii, p. 439, pl. xxviii, f. 3. D.F.

1915. Dorcasia alexandri Gray, var. trivia Bttg., Conn., Ann. S.A. Mus., xiii, p. 171. D.

1930. Dorcasia alexandri Gray, var. trivia Bttg., Conn., Ann. S.A. Mus., xxix, p. 286. D.

The shell is intermediate in size between the typical form and var. *minor*; elevation of whorls and general form of aperture and umbilicus similar to type, but the sculpture consists of raised, rather distant costae, from  $\frac{1}{2}$  to 1 mm. apart, whereas the fine striae of *alexandri* are far closer together, 3 to the mm. on the last whorl.

Böttger states that thirteen specimens measured from 24 to 30 mm. in diameter and 14 to 15 in altitude.

Hab. DAMARALAND. Kama's Highlands (Schultze).

Type in Senckenberg Museum.

# var. perspectiva Conn.

1915. Dorcasia alexandri Gray, var. perspectiva Conn., Ann. S.A. Mus., xiii, p. 172, pl. iii, f. 8. D.F.

1929. Dorcasia alexanderi Gray, var. perspectiva Conn., Adens., Ann. Nat. Mus. Wien, xiii, p. 390. N.

1930. Dorcasia alexandri Gray, var. perspectiva Conn., Ann. S.A. Mus., xxix, p. 287. N.

1932. Dorcasia alexandri Gray, var. perspectiva Conn., Furreg, Zool. Jahrb. Jena, Anat., lv, pp. 222, 230. N.F.

Differs from *trivia* in having even coarser sculpture and in its umbilicus being very broad and deep, an open circle, without strangulation. The type measures Diam. maj. 29·0, min. 22·0; alt. 12·8; apert. alt. 11·5, lat. 13·8 mm., and other

specimens range downward to 22.0 × 10.1 mm. in breadth and height.

Hab. DAMARALAND. Omaruru R. (type, Wohlfahrt); Nobgams and Neineis, Omaruru R.; Uis, near Brandberg (Haughton); Okambahe (Lebzelter).

Type in Kimberley Museum.

#### var. montana Conn.

1915. Dorcasia alexandri Gray, var., Conn., Ann. S.A. Mus., xiii, p. 177. D.N.

1916. Dorcasia alexandri Gray, var. montana Conn., ibid., p. 179. D.F.

1928. Dorcasia alexanderi Gray, var. montana Conn., Haas, Senckenbergiana, x, p. 92, f. 3-4; p. 93. N.F.L.

1929. Dorcasia alexanderi Gray, var. glabra Adens., Ann. Nat. Mus. Wien, xiii, p. 388, pl. xii, f. 2; pl. xiii, f. 3-4. D.F.

1930. Dorcasia alexandri Gray, vars. montana Conn. and glabra Adens., Conn., Ann. S.A. Mus., xxix, p. 287. D.N.L.

1932. Dorcasia alexandri Gray, var. glabra Adens., Furreg, Zool. Jahrb. Jena, Anat., lv, pp. 223, 226. N.

The shell combines the finer sculpture, though rather more pronounced, of alexandri typica with the deep, well-like umbilicus of trivia. The type measures Diam. maj. 27·9, min. 22·5; alt. 14·1; apert. alt. 13·0, lat. 16·2 mm., while other examples range from  $34\cdot5\times16\cdot4$  to  $21\cdot7\times10\cdot0$  mm. in breadth and altitude.

Hab. DAMARALAND. Mt. Usakos (type, Frames); Erongo Mts. (Rogers); Okambahe (var. *glabra*, Lebzelter).

GREAT NAMAQUALAND. Bullspoort (Tucker); Naauwkloof, and mountains between there and the Namib border (in Senckenberg Museum); Rehoboth District (Edlinger).

Type of montana in British, glabra in Vienna Museum.

The var. glabra was founded on eleven examples, ranging from 27.0 to 35.9 mm. in major diameter; it was differentiated from montana by reason of weaker sculpture and wider umbilicus, but these points do not persist in large series, and are therefore hardly sufficient to justify even sub-varietal distinction.

# var. reflexilabris n.

(Pl. viii, f. 9-11.)

A large form of typical alexandri, remarkable for the extraordinarily strong expansion and reflexion of the peristome into a deep channel, capable of holding water. The shell in fresh condition is bright chestnut brown, paler on base and nearly white in the peristomatal canal. The type, somewhat faded, but with perfect aperture, consists of 4 whorls and measures

Diam. maj. 33·3, min. 24·0; alt. 14·9; apert. alt. 11·8, lat. 9·7 mm.

Hab. GREAT NAMAQUALAND. Chaibis Farm, Nadas Mine (Edlinger).

Type in Berlin Museum.

Six examples, all similar in peristomatal process; largest  $35.2 \times 26$ , alt. 16.8, and smallest  $31.4 \times 22.0$ , alt. 14.8 mm.

(ii) Shell of recent species in freshest condition mottled fawn and cream; ends of peristome discontinuous.

#### Dorcasia kaiseri Wenz.

1926. Dorcasia kaiseri Wenz, Diam.-Wüste S.-W.-A., ii, p. 156, pl. xxxix, f. 5. D.F.

1930. Dorcasia kaiseri Wenz, Conn., Ann. S.A. Mus., xxix, p. 289.  $N_{\star}$ 

This fossil resembles *alexandri* in form and sculpture, but the perforation is wide and not strangulate and the peristome not entirely free; it is said to differ from *cernua* chiefly in its larger size. The shell has  $5-5\frac{1}{2}$  whorls and measures

Diam. maj. 40-45, min. 30-34; alt. 17; apert. alt. (in shell of 40 mm.) 19.5 mm.

Hab. NAMIB. Neu Gamachabbrunnen, 7 km. S.E. of Bogenfels, in calcareous sandstone (fossil, Kaiser & Beetz).

Type in Munich Museum.

#### Dorcasia antiqua Wenz.

1926. Dorcasia antiqua Wenz, Diam.-Wüste S.-W.-A., ii, p. 157, pl. xxxix, f. 7. D.F.

1930. Dorcasia antiqua Wenz, Conn., Ann. S.A. Mus., xxix, p. 289. N.

Founded on a single fossil with damaged peristome; the spire is somewhat exserted, the  $5\frac{1}{2}$  whorls regularly, extremely finely and closely striate and increase more regularly than in *alexandri*, so that the last whorl is comparatively narrower; the perforation resembles that of *cernua*, but the spire is higher.

Diam. maj. over 40, min. 32; alt. ca. 20 mm.

Hab. NAMIB. Marly sandstone at Chalcedontafelberg, west of the old Lüderitz fields (eocene, Kaiser & Beetz).

Type in Munich Museum.

#### Dorcasia rogersi Conn.

1915. Dorcasia rogersi Conn., Ann. S.A. Mus., xiii, p. 164, pl. iii, f. 2-3; pl. iv, f. 15, 23; pl. v, f. 7; text-fig. 1. D.F.A.R.

The type is rather small, depressed orbicular, perforate, translucent, smooth, creamy white, with slight irregular fawn blotches and spots, which are chiefly present on the 3rd whorl, apex pale corneous, peristome glossy white. Spire depressed. Whorls 5, the 2 apical smooth, remainder sculptured with close transverse striae, which become rather coarser and less regular towards the aperture and are hardly visible on the base; suture deep. Aperture almost circular, peristome reflexed, ends joined by very slight callus, columella very weak, margin slightly thickened and reflexed but not approaching the umbilicus, which is perspective and deep, but narrow and somewhat excentric.

Diam. maj. 21·1, min. 17·5; alt. 11·7; apert. alt. 8·9, lat. 9·7; ends of peristome

apart 4.3 mm., while the smallest of type set is  $18.3 \times 8.0$  mm.

Jaw 1·3 mm. long, rather narrow, thin, yellow-brown; radula  $3\cdot9\times1\cdot3$  mm., teeth broad and short, ectocones present on about two-thirds; formulae  $(35+1+37)\times128$  and  $(30+1+30)\times137$ .

Hab. LITTLE NAMAQUALAND. T'Kaigas (type, Rogers); Henkries District (Lightfoot); Steinkopf; Richtersveld Mts. (per de Villiers).

Type in South African Museum.

The smallest examples were selected for the type set, as their anatomy was available, but the Henkries shells are much larger, ranging from 27.9 to 33.9 mm. in diameter and establishing transition through a forma *major* to one worthy of the name *maxima* (vide infra).

The internal anatomy bears some resemblance to that of *D. coagulum*, but the radula is very distinct, there being fewer teeth in each row, and their shape, especially that of the inner marginals, different.

#### var. maxima Conn.

1915. Dorcasia rogersi Conn., Ann. S.A. Mus., xiii, p. 165, pl. iii, f. 3. N.F.

1930. Dorcasia rogersi, forma maxima Conn., ibid., xxix, p. 288. D.L.

Much larger than type, averaging about  $33\frac{1}{2} \times 18$  mm. in breadth and altitude.

Hab. LITTLE NAMAQUALAND. Henkries District (Lightfoot). GREAT NAMAQUALAND. Aiais and Klipneus, north bank of Orange R. (Haughton).

# Dorcasia cernua (Mts.). Ref. List No. 284.

1889. Helix cernua Mts., Sitz.-Ber. Ges. Nat. Fr. Berlin, p. 161. D. 1915. Dorcasia cernua Mts., Conn., Ann. S.A. Mus., xiii, p. 166, pl. iii, f. 4. D.F.

1926. Dorcasia cernua Mts., Wenz, Diam.-Wüste S.-W.-A., ii, p. 156, pl. xxxix, f. 6. N.F.

1928. Dorcasia cernua Mts., Haas, Senckenbergiana, x, p. 93. L. " Conn., Ann. S.A. Mus., xxix, p. 287, 1930. pl. iii, f. 2-4. D.F.

Shell depressed globose, umbilicate, nearly smooth, glossy, semi-transparent, first  $2\frac{1}{2}$  whorls fawn, remainder mottled pale fawn and cream, peristome white and glossy. Spire little exserted, though each whorl rises clearly above the next, usually to a greater extent than in the almost flat type. Whorls  $5\frac{1}{2}$ , first  $1\frac{3}{4}$  practically smooth, remainder sculptured with close, regular, weak, curved oblique striae, weaker on base, and a certain amount of faint malleation on the later whorls; suture well defined. Aperture ovate, peristome slightly thickened and expanded, nearly continuous, ends united by a strong white callus, labrum receding in a slight curve to the base, columella concave, margin reflexed, but scarcely overhanging the broad deep umbilicus.

Diam. maj. 27-2, min. 21-9; alt. 15-9; apert. alt. 11-3, lat. 13-1; ends of peristome almost confluent.

The type measures  $30.5 \times 12.5$ , and other specimens examined range downward to  $15.5 \times 9.0$  mm. in breadth and height, one of the smallest having been figured by the present author in 1930.

Hab. GREAT NAMAQUALAND. Anganthal (type) and Rooiberg, Bethany District (Schenck); Kuibis (Schultze); Kwab's and Viols Drifts, north of Orange R., Warmbad District (Haughton); Witputz (Range); Duwisit, 170 miles south-west of Windhoek (Murman); Holoog Berg, Great Fish R. Mts.; Klein Karas Mts. (Miss A. Hill).

Type in Berlin Musuem.

Though never much exserted, the spire varies in height, few specimens being as flat as the type, so that in the majority the face of the aperture does not rest quite flat on the ground in frontal aspect but is slightly raised; the beautiful mottling is most evanescent, usually bleaching white, even in fresh live specimens.

Watson reports that the animal from the shell described above has a radula and genital organs approaching very nearly those of rogersi, which was differentiated at a time when the anatomy and all but two shells of cernua were unknown, and he suggests that the two forms may bear to one another the same relation as do the rimate alexandri to its widely perforate varieties, perspectiva and montana. This appears a most reasonable suggestion, but since the two forms have been placed on specific footing, it may be well to leave them thereon pending further anatomical investigation.

# Dorcasia coagulum (Mts.) Ref. List No. 288.

1889. Helix coagulum Mts., Sitz.-Ber. Ges. Nat. Fr. Berlin, p. 160. D.

1915.  $Dorcasia\ coagulum\ Mts.,\ Conn.,\ Ann.\ S.A.\ Mus.,\ xiii,\ p.\ 162,$ pl. iii, f. 1; pl. iv, f. 5, 14, 22, 26, 30; pl. v, f. 6. D.F.A.R.

1930. Dorcasia coagulum Mts., Conn., ibid., xxix, p. 288. N.

Shell rather large, subglobose, narrowly umbilicate, similar in texture and creamy mottling to the last two species. Spire somewhat exserted, apex roundly obtuse. Whorls  $5\frac{1}{2}$ , all but the apical covered with close, faint, regular, transverse striae, becoming much fainter beneath. Aperture truncate ovate, peristome slightly reflexed, ends joined by a very faint callus, umbilicus very deep and narrow, somewhat strangulate. A typical example measures

Diam. maj.  $2\overline{2}$ ·8, min.  $18\cdot\overline{5}$ ; alt.  $17\cdot\overline{2}$ ; apert. alt.  $11\cdot0$ , lat.  $13\cdot2$ ; ends of peristome apart  $5\cdot6$  mm. Other examples range from  $25\cdot3\times15\cdot5$  to  $20\times14$  mm. in

diameter and altitude.

Hab. GREAT NAMAQUALAND. Between Aos and Orange River (type, Schenck).

LITTLE NAMAQUALAND. Stinkfontein; Fieldings Chabeesies (Rogers); Steinkopf; Helskloof, Richtersveld (per de Villiers).

Type in Berlin Museum.

Jaw 1·6 to 1·7 mm. long, rather narrow, thin, yellow-brown; radula  $4\cdot6\times1\cdot8\,$  mm., cusps of inner marginals longer than in the other species, ectocones on about 70 per cent. of the teeth, though sometimes very small, formula  $(45+1+45)\times137$  and in another specimen  $(48+1+48)\times135$ .

The shell differs from others of the genus in its more globose form; it approaches *Trigonephrus* more nearly than the rest, but the form of the kidney, tripartite foot-sole, penial structure, and unicuspid central and lateral teeth prove it to belong to *Dorcasia*.

Genus Tulbaghinia M. & P., 1898 (A.M.N.H. i, p. 28). Type T. isomerioides (M. & P.).

Characters of shell as in monotype; anatomy agreeing in some respects with *Dorcasia*, but in others with *Trigonephrus*.

# Tulbaghinia isomerioides (M. & P.).

(Text-fig. 23.)

Ref. List No. 287.

1898. Dorcasia (Tulbaghinia) isomerioides M. & P., A.M.N.H., i, p. 28, pl. viii, f. 10. D.F.

1915. Tulbaghinia isomerioides M. & P., Conn., Ann. S.A. Mus., xiii, p. 174. D.

1934. Tulbaghinia isomerioides M. & P., Watson, Proc. Mal. Soc., xxi, p. 154. A.

Shell large, depressed globose, umbilicate, silky, semi-transparent, corneous red-brown above, slightly mottled with dark and paler shades, paler beneath.

Spire little exserted, apex obtuse. Whorls  $5\frac{1}{4}$ , rather rapidly increasing, moderately convex, rounded at periphery, sculptured all over with curved, oblique striae, the whole surface shagreened and somewhat irregularly malleate. Aperture oblong ovate, peristome white, glossy, narrowly reflexed, labrum straight and receding considerably in profile, columella oblique, sharply angulate over the umbilicus shortly before

C 16

Text-fig. 23.—Tulbaghinia isomerioides M. & P., Tulbagh.

Representative teeth from radula;  $\times 300$ .

joining the paries; there are 3 glossy white tubercles on the inner margin of the peristome on the left of the base, just below the columella; umbilicus deep, narrow, slightly strangulate.

Diam. maj. (type) 29.2, min. 24.1; alt. 16.1; apert. alt. 14.5, lat. 12.7 mm.

Hab. CAPE PROVINCE. Winterhoek Mountain, Tulbagh (type, Marloth); Mostert's Hoek Peak, 4000-5500 feet; Brandwacht-Fonteinjesberg Mts., north of Worcester, 3000 feet (Barnard).

Type in British Museum.

The amount of mottling varies in individuals, some of which show traces of narrow dark or light bands; the peristomatal tubercles also vary in strength and number, and may well be an adventitious feature caused by grains of sand adhering to the slimy surface of the lip just before periods of growth. The largest specimen I have seen is 33.7 mm. in major diameter.

The radula (text-fig. 23) measures  $5.5 \times 1.7$  mm. when flattened, number of rows about 145 + nascent, formula 45 + 1 + 45. Central rather small; laterals nearly equal to about line 10, changing gradually to form of line 16. The depression in the outer cutting edge eventually results in an ectocone, which appears in some of the teeth on line 29 and in most of them on the remaining outer lines; the outermost 3 or 4 lines are rudimentary.

This radula resembles somewhat nearly that of *Dorcasia alexandri*, but not those of *Trigonephrus porphyrostoma* or *rosaceus* (forma minor).

The jaw measures about  $1.5 \times 0.3$  mm.; in transmitted light it appears to be weakly decussated by striae at right angles to one another.

Genus *Trigonephrus* Pilsb., 1905 (Proc. Mal. Soc. vi, p. 286). Type *Helix globulus* Müll.

Shell somewhat globose, perforate, rather solid and less regularly striate than in *Dorcasia*; aperture rather large, peristome thickened. Animal differing from *Dorcasia* in the following main respects: Footsole without longitudinal grooves; kidney broader at anterior end; pedal gland embedded in muscles of foot; receptacular duct less than twice the length of the free oviduct, which is greatly swollen; penis having corrugated longitudinal ridges; jaw rather broad, more than 2 mm. long, radula about twice as long as broad, with larger teeth, central and laterals tricuspid, marginals becoming bicuspid or unicuspid.

- (i) Shell normally considerably more broad than high.
  - (a) Peristome and columella coloured.

Trigonephrus ambiguosus (Fér.).

Ref. List No. 286.

1821. Helix (Helicella) ambiguosa Fér., Tabl. Syst., part 3, p. 47. L. 1848. ,, lucana Müll., var. β, peristomate aurantiaco, Pfr., Mon. Hel., i, p. 332. D.

1850. Helix lucana Müll. (ambiguosa Fér.), Desh., Hist. Nat. Moll., pl. xB, f. 3–5.  $\,\,F.$ 

1910. Dorcasia ponsonbyi Fulton, A.M.N.H., vi, p. 212. D.

1915. Trigonephrus ambiguosus Fér. (= ponsonbyi Fult.), Conn., Ann. S.A. Mus., xiii, p. 159, pl. ii, f. 11. D.F.

Shell rather large, depressed globose, umbilicate, smooth, translucent, bright corneous brown above, much paler, shading to grey beneath, peristome and callus bright orange-brown. Spire but little exserted, whorls  $4\frac{1}{2}$ , rounded, rapidly increasing, first  $1\frac{1}{2}$  smooth, remainder covered with close, faint, curved striae, with little malleation but with tracts of microscopic granular sculpture, which is most apparent on the upper part of the last whorl; suture simple, shallow. Aperture truncate ovate, peristome a little thickened, narrowly reflexed, ends joined by a thin callus; umbilicus deep but narrow and a little strangulate.

Diam. maj. 28·3, min. 23·1; alt. 15·8; apert. alt. 11·7, lat. 15·7; ends of peristome

apart 7.7 mm.

Hab. CAPE PROVINCE. Le pays des Hottentots (ambiguosus, fide Férussac); Mossel Bay (Gibbons); Vleesch Bay (Power).

Type of ambiguosus ubi? ponsonbyi in British Museum.

Deshayes (1850) omits to mention the colour of the peristome in his description, the rest of which is indefinite, but the shell he figures, admittedly *H. ambiguosa* Fér., obviously shows a coloured peristome, proving it to be distinct from *lucana* and establishing Férussac's name.

The comparative breadth of the last whorl varies greatly in this species; in most examples it expands considerably towards the aperture, but in some cases more so than in others, and this expansion influences the shape of the umbilicus, which becomes more crooked and strangulate according to the amount of expansion. This point, together with the more flattened spire and coloured peristome, serves to distinguish it at a glance from *T. lucanus*.

The largest shell examined is  $33 \times 19$  and the smallest  $25.8 \times 15.8$  mm. in diameter and altitude.

#### var. compactus Conn.

1915. Trigonephrus ambiguosus Fér., var. compactus Conn., Ann. S.A. Mus., xiii, p. 160, pl. ii, f. 12. D.F.

Shell subglobose, smaller, closer coiled and higher spired than type, but similar in sculpture and coloration; the aperture is more circular than in type, and the narrow umbilicus not strangulate.

Diam. maj.  $24\cdot 1$ , min.  $20\cdot 8$ ; alt.  $19\cdot 2$ ; apert. alt.  $10\cdot 8$ , lat.  $13\cdot 5$ ; ends of peristome apart  $7\cdot 7$  mm.

Hab. SOUTH AFRICA (Layard), possibly from George District. Type in British Museum.

# (b) Peristome and columella white.

Trigonephrus lucanus (Müll.).

Ref. List No. 285.

1774. Helix lucana Müll., Verm., ii, p. 75. D.

1905. Dorcasis lucana Müll., Sykes, Proc. Mal. Soc., vi, p. 269. N.

1915. Trigonephrus lucanus Müll., Conn., Ann. S.A. Mus., xiii, p. 156, pl. ii, f. 10; pl. iv, f. 4, 13, 21, 29; pl. v, f. 5, 10. D.F.A.R.

Less depressed than typical ambiguosus, deeply umbilicate, chestnut brown with a narrow infrasutural white band, peristome white, interior pale brown. Whorls 5, all except first  $1\frac{1}{2}$  covered with very close, faint, regular, transverse striae, extending more faintly into the umbilicus, and faint malleation, more pronounced towards the aperture; suture rather shallow and crenulate. Aperture truncate ovate, peristome slightly thickened and reflexed, ends joined by a faint callus,

umbilicus narrow but deep, extending to the apex.  $\Lambda$  typical specimen from Cape Point measures

Diam. maj. 29·2, min. 23·2; alt. 20·0; apert. alt.  $13\cdot5$ , lat.  $16\cdot7$ ; ends of peristome apart 7 mm.

Jaw rather thin, reddish brown along lower side, ends squarer and edges more nearly parallel than in the higher-spired species; radula  $5\times 2\frac{1}{2}$  mm., central similar to inner laterals but a little smaller; formula of specimen from Montagu  $(43+1+43)\times 114$ ; in another, from Kommetje, the radula is  $6\frac{1}{2}\times 2\frac{1}{2}$  mm., the teeth larger, and formula  $(35+1+36)\times 113$ .

Hab. CAPE PROVINCE. Frequent in the south-western districts; George District; Bredasdorp (Layard); Montagu (Connolly); Avontuur (fide Pfeiffer); Onrust (Rennie); Lemoenshoek; Kleinmont, sand dunes near coast (Barnard); Hermanus; Rabies Berg, Worcester Div. (Barnard); Robertson (G. Mills); Still Bay; Lappiesbay (per de Villiers).

CAPE PENINSULA, from Kalk Bay and Hout Bay to Cape Point (frequent).

Type in Copenhagen Museum.

Sykes has recorded the existence of a sinistral form, while beautiful albino examples in live condition have been collected in the Cape Peninsula.

A subfossil series from Kalk Bay contains shells of the following dimensions:—

Diam. maj. 38·6, min. 31·0; alt. 29·5; apert. alt. 14·9, lat. 21·1 and , 32·4 ,, 25·5 ,, 22·0 ,, 13·7 ,, 15·5 mm. The inland race at Montagu is slightly smaller and of thinner texture than the coastal, but not varietally separable.

While in its radula and most other organs *T. lucanus* agrees closely with such of the following species as have been described anatomically, it departs from them in its depressed shell and some features of its reproductive system, such as its remarkably long penis. It bears a slight superficial resemblance to the genus *Dorcasia*, and is, perhaps, one of the least primitive members of the genus.

var. nana Conn. (Pl. viii, f. 6-8.)

1915. Trigonephrus sp. 3, Conn., Ann. S.A. Mus., xiii, p. 176. N. 1931. ,, lucanus Müll., var. nana Conn., A.M.N.H., viii, p. 306, pl. x, f. 6–8. D.F.

Differs from type in its smaller size for the same number  $(4\frac{1}{2})$  of whorls; the shell is therefore much compressed and of comparatively greater altitude, while

Diam. maj. 19.5, min. 15.5; alt. 16.2; apert. alt. 10.5, lat. 9.0; ends of peristome

apart 5.7 mm.

Hab. NAMAQUALAND (type, ex coll. Layard). CAPE PROVINCE. Swellendam (Barnard). Type in British Museum.

- (ii) Height and breadth of shell nearly equal.
  - (a) Peristome and columellar region coloured.
     Trigonephrus globulus (Müll.).
     Ref. List No. 289.

1774. Helix globulus Müll., Verm., ii, p. 68. D.

1895. , rosacea Müll., Cooke, Camb. Nat. Hist., Moll. and Brach., p. 259, f. 167. N.F.

1899. Dorcasia globulus Müll., Moss & Webb, Proc. Mal. Soc., iii, p. 264. A.

1905. Dorcasia globulus Müll., Sykes, Proc. Mal. Soc., vi, p. 269. N.

1915. Trigonephrus globulus Müll., Conn., Ann. S.A. Mus., xiii, p. 143, pl. ii, f. 1-2; pl. iv, f. 1, 7, 9, 17, 27; pl. v, f. 1, 9. D.F.A.R.

1932. Trigonephrus globulus Müll., Thiele, Handb. Syst. Weichtierk., p. 647. A.

1932. Trigonephrus globulus Müll., Furreg, Zool. Jahrb. Jena, Anat., lv, pp. 225, 227, pl. iv. N.F.

Shell large, globose, umbilicate, solid, translucent, early whorls red-lilac above, later violet-blue, with occasional whitish mottling and small dark spots, and a narrow infrasutural white band; under part paler, almost white; peristome, callus, and interior reddish purple. Spire somewhat exserted, apex rounded. Whorls 5, rounded, regularly and rapidly increasing, the apical smooth, remainder covered with very fine, close, transverse striae, with irregular malleation on the upper part of the later whorls and occasional traces of microscopic spiral sculpture; suture well defined, subcrenulate. Aperture quadrate-ovate, peristome thickened and somewhat reflexed, ends joined by a thin callus, outer lip making with body whorl an angle of about 125° and imparting a drooping appearance to the aperture; columella erect, slightly concave, margin reflexed, partially concealing the narrow umbilicus. A typical specimen from Hout Bay measures

Diam. maj. 30·3, alt. 32·0; apert. alt. 19·0, lat. 15·7; ends of peristome 15 mm. apart, but the species varies much in size, the Robben Island race attaining  $40 \times 38 \cdot 5$  mm. in altitude and diameter, while Layard has recorded some as small as  $19 \times 19$  mm. from George District, others from Milnerton and Dassen Island

being about  $22.5 \times 21.5$  mm.

Hab. CAPE PROVINCE and CAPE PENINSULA. Generally distributed along the coast from Algoa Bay (fide Layard) to St. Helena Bay; Robben and Dassen Islands.

Original in Copenhagen Museum; a large sinistral specimen from Robben Island is in the British Museum.

Jaw reddish brown, more curved than usual, with scarcely a trace of median projection; radula  $6\frac{1}{2} \times 3\frac{1}{4}$  mm., teeth relatively larger and less numerous than in allied species, central very similar to laterals, with large middle cusp and a small one on each side, outer marginals longer and narrower than usual, with single cusps; formula  $(45+1+48) \times 115$ .

The peristome is sometimes thickened a little squarely, but less markedly so than in T. rosaceus or porphyrostoma; apart from the large teeth of the radula the most distinctive anatomical features are the jaw, long epiphallus and internal structure of the penis.

The beautiful bluish colour soon fades, becoming pale red on fairly fresh shells and then quickly bleaching, but the peristome retains a roseate tint a considerable time longer.

# Trigonephrus gypsinus (M. & P.). Ref. List No. 290.

1891. Helix (Dorcasia) gypsina M. & P., A.M.N.H., viii, p. 238. D. 1915. Trigonephrus gypsinus M. & P., Conn., Ann. S.A. Mus., xiii, p. 147, pl. ii, f. 3. D.F.A.R.

1930. Trigonephrus gypsinus M. & P., Conn., Ann. S.A. Mus., xxix, p. 283. L.

Shell comparatively small, globose, umbilicate, rather thin, translucent, uniform pinkish drab, aperture and paries pale rosy brown. Spire somewhat produced, as long as aperture, apex bluntly rounded. Whorls nearly 5, rounded, rapidly increasing, apical  $1\frac{1}{2}$  smooth, remainder covered with extremely faint, close, transverse striae and showing considerable malleation, especially on the upper part of the last  $1\frac{1}{2}$  whorls; suture well defined. Aperture comparatively small, quadrately rounded, the ends  $10\cdot 2$  mm. apart, joined by a faint, polished callus; labrum making with body whorl an angle of about  $125^\circ$ , peristome considerably thickened, reflexed, columella rather concave, margin reflexed, partly concealing the narrow umbilicus. Two specimens measure

Diam. maj. 24.5; alt. 24.4; apert. alt. 13.6, lat. 10.1 mm. and , 20.2 , , 22.3 , 11.5 , , 9.2 ,

Hab. LITTLE NAMAQUALAND. Springbok (type, Lightfoot; Day); Henkries (Lightfoot); Wilde Paards Hoek; Kaitop (Rogers). NAMIB. 90 km. south of Lüderitzbucht (in South African Museum).

Type in British Museum.

The type, which the authors appear to have imagined to be in fresh condition, is so weathered and calcined that the sculpture is almost obliterated and the original colour indeterminable, but the peristome appears to have been pink or brown in hue, otherwise it would probably be referable to *namaquensis*. It is a narrower form than that described above: alt. 24, diam. maj. 20; apert. alt. 11, lat. 9; last whorl 21 mm.; ends of peristome 8.8 mm. apart.

Jaw rather thin, light brown, radula  $6\frac{1}{3} \times 3\frac{1}{2}$  mm., central very similar to laterals, marginals lacking endocone, formula  $(53+1+53) \times 133$ .

Probably a relatively primitive member of the genus; in internal anatomy it possesses few distinctive characters which are not found in other species, but in different combinations; it differs from *T. rosaceus* in its short vagina and swollen hermaphrodite duct, and from *globulus* in its jaw, epiphallus, and penis; the number of transverse rows of teeth in the radula is greater than in any other member of the genus that has been examined, in this respect approaching *Dorcasia*.

#### Trigonephrus rosaceus (Müll.). Ref. List No. 293.

1774. Helix rosacea Müll., Verm., ii, p. 76. D.

1915. Trigonephrus rosaceus Müll., Conn., Ann S.A. Mus., xiii, p. 150, pl. ii, f. 4-5; pl. iv, f. 10, 18; pl. v, f. 2. D.F.A.R.

1926. Trigonephrus rosaceus Müll., Wenz, Diam.-Wüste S.-W.-A., ii, p. 155 (part 2), pl. xxxix, f. 3. N.F.L.

1928. Trigonephrus rosaceus Müll., Haas, Senckenbergiana, x, p. 91. N.L.

1930. Trigonephrus rosaceus Müll., Conn., Ann S.A. Mus., xxix, p. 284 (pars, omitting many localities and figure). N.L.

The shell is typically larger than globulus and readily distinguishable by its less exserted spire and more horizontal aperture, the outer lip leaving the body whorl at an angle of about 105°. The colour shades from pinkish buff on the earlier to bluish violet on the last whorl, interior nacreous blue, peristome and paries purple-brown. Whorls 5, very convex, all but the apical covered with close, straight, regular, transverse striae, and showing occasional traces of close, faint spiral sculpture, while there is always some amount of malleation, which in some examples is so pronounced as almost to efface the striation, while in others there is little malleation and the striation is far more clear; the peristome is thickened and either simply narrowly reflexed, or thickened backward for as much as  $3\frac{1}{2}$  mm. and then squarely grooved rather than reflexed, but this feature, which occurs in most of the globulus group, is quite inconstant, even among specimens from the same locality. The shell with which I dealt in 1915 measures

Alt. 39·2, diam. 42; apert. alt.  $20\cdot5$ , lat.  $24\cdot5$  mm.; ends of peristome  $16\cdot5$  mm. apart.

Jaw thick, dark brown, radula  $7\frac{3}{4} \times 4\frac{1}{4}$  mm., central and laterals

with rather broad base and narrow median cusps, formula  $(62 + 1 + 66) \times 124$ .

Hab. CAPE PROVINCE. Saldanha Bay (Miss Wilman).

LITTLE NAMAQUALAND. Between the Holgat and Orange Rivers; Koingnaas; Hondeklip Bay, subfossil (Rogers); Port Nolloth; Anenous (Day).

GREAT NAMAQUALAND. West of Aurus and south of Kubub near Aus (Range).

NAMIB. Neu Gamachabbrunnen, 7 km. south-east of Bogenfels (subfossil, Kaiser & Beetz); Granitberg, 85 km. south of Lüderitzbucht (subfossil); near Bogenfels (Lotz); Kolmanskop near Lüderitzbucht (Braunfels); south of the Bushelberg, Lüderitzland (Range); dunes west of Lüderitzbucht (in Senckenberg Museum).

Some of the last-named localities may refer to T. haughtoni rather than the present species.

Specimen ex auct. in Copenhagen Museum.

The large typical form of T. rosaceus seems to be pretty generally distributed in the neighbourhood of the Lower Orange River; the examples from Anenous, Koingnaas, and east of Port Nolloth are smaller, about  $25\frac{1}{2}$  mm. in altitude and diameter.

The reproductive organs differ from globulus and gypsinus in the long vagina, while rosaceus appears to differ from the former also in its jaw, receptacular duct, epiphallus and penis, and from the latter in its mantle edge, hermaphrodite duct, and vesicula seminalis.

# Trigonephrus porphyrostoma (M. & P.). Ref. List No. 292.

1891. Helix (Dorcasia) porphyrostoma M. & P., A.M.N.H., viii, p. 238. D.

1915. Trigonephrus porphyrostoma M. & P., Conn., Ann. S.A. Mus., xiii, p. 152, pl. ii, f. 6; pl. iv, f. 2, 11, 19, 25, 28; pl. v, f. 3; text-fig. 1, A. B. D.F.A.R.

1930. Trigonephrus porphyrostoma M. & P., Conn., ibid., xxix, p. 284. L.

Shell large, slightly elevate globose, solid, smooth, shading in colour from pale pink on the earlier to bluish grey on the later whorls, peristome and interior purple-brown. Spire nearly as long as aperture, whorls  $5\frac{1}{2}$ , convex, all but the first 2 faintly and irregularly malleate above and covered with straight transverse striae, which become coarse and more distant with the growth of the shell and assume a rib-like aspect towards the aperture; suture deep, subcrenulate. Aperture quadrate, peristome reflexed, usually much thickened backwards, ends joined by a distinct callus, outer lip making with body whorl an angle of nearly

 $120^\circ;$  columella erect, margin broadly reflexed, almost concealing the narrow perforation. A typical example measures

Alt. 41.5, diam. 39.7; apert. alt. 23.5, lat. 20.4; ends of peristome apart 18.3 mm.

Jaw thick, dark brown, radula  $7\frac{1}{2} \times 4\frac{1}{4}$  mm., central narrow, with rather inconspicuous side cusps, outer marginals unusually broad, mesocones prominently bifid on a larger number of teeth than in the other species; formulae  $(61+1+62) \times 124$  and  $(63+1+62) \times 128$ .

Hab. LITTLE NAMAQUALAND (type, Miss Morris); Port Nolloth (Day); T'Kaigas; between the Holgat and Orange Rivers; Koingnaas; Houndeklip Bay (Rogers); Alexander Bay (in Albany Museum).

BECHUANALAND. Lower Orange River; Ghous, Molopo R., Gordonia Dist. (Schenck).

NAMIB. Angra Pequenas (= Lüderitzbucht) (Schneider).

Type in British Museum.

This coarse form of *Trigonephrus* is that most frequently found on old middens; the shell is easily distinguishable from *rosaceus* by its more exserted spire, grey coloration, and coarser, rib-like, less malleate sculpture, but the animal and most of the internal anatomy closely resemble that species; the radula, however, differs considerably from that of *rosaceus*, especially in the form of the central teeth, and slight differences seem to be present in some of the soft parts, such as the vesicula seminalis.

## Trigonephrus heliocaustus Conn.

1929. Trigonephrus heliocaustus Conn., Ann Natal Mus., vi, p. 230, pl. xiv, f. 23. D.F.

Shell large, globose, translucent, creamy white just above the sutures, on the base, and for a short distance before the aperture, remaining surface brownish blue-black, peristome and columellar region reddish purple, paries and interior pink. Spire moderately exserted, whorls 5, convex, showing, after the 1st, faint, close, regular, slightly curved transverse striae, which soon become crossed by rather weak, irregular spiral lines, producing a granular appearance, which is increased on upper part of last whorl by numerous irregular, branching, transverse wrinkles; under part of shell almost smooth; suture well defined. Aperture nearly circular, peristome thickened and reflexed, columella concave, margin triangularly reflexed, half covering the umbilicus; callus thin and colourless.

Alt. 37·1; diam. maj. 37·5, min. 30·4; apert. alt. 20·0, lat. 15·8 mm.

Hab. CAPE PROVINCE. Klaver, Van Rhynsdorp District (type, Ross Frames); Gamoeb, Bushmanland (in South African Museum).

Type in British Museum.

The peristome may be simply glossy and reflexed, or strongly adnately thickened backwards on the body whorl; the shell is nearest vol. xxxIII.

that of *rosaceus*, where, however, the transverse striation is stronger and the spiral almost absent, while its glorious coloration combines with its size to render *heliocaustus* the most striking of all African Helicoids.

## Trigonephrus haughtoni Conn.

1886. *Buliminus* sp., O. Bttg., Ber. Senckenb. Ges., p. 16, pl. i, f. 2. *D.F.A*.

1926. Trigonephrus rosaceus Müll., Wenz, Diam.-Wüste S.-W.-A., ii, p. 155 (part 1), pl. xxxix, f. 1–2. N.F.L.

1930. Trigonephrus rosaceus Müll., Conn., Ann. S.A. Mus., xxix, pp. 284, 286, f. 1. N.F.L.

1931. Trigonephrus haughtoni Conn., A.M.N.H., viii, p. 307. D.

Differs greatly from *rosaceus* in more exserted spire and drooping aperture, and while the sculpture resembles that of *rosaceus* in its transverse striation, with peculiar strong crinkles between the striae, the former is stronger and the latter closer. The normal coloration is dark brown, with a few irregular pale streaks and patches. The type, with 5 whorls, measures

Alt. 32·4; diam. 29·8; apert. alt. 18·5, lat. 14·0 mm., while the largest example seen is  $39 \times 28$ , apert.  $21 \times 17$  mm.

Hab. NAMIB. (a) Recent: Bogenfels Diamond Fields (type, Spencer); Orange River mouth (Haughton); Buntfeldschau, E. Bogenfels (Kaiser & Beetz). (b) Subfossil: vlei south of Lochkuppe, Klingharal Gebirge; Elfertstafelberg; Feld Lubeck, 12 km. south-east of Lüderitzbucht (Kaiser & Beetz); Orange River mouth and Alexander Bay (Haughton); Granitberg (per de Villiers).

Type in British Museum.

# (b) Peristome and columellar region white.

Trigonephrus namaquensis (M. & P.). Ref. List No. 291.

1891. Helix (Dorcasia) namaquensis M. & P., A.M.N.H., viii, p. 237. D.

1915. Trigonephrus namaquensis M. & P., Conn., Ann. S.A. Mus., xiii, p. 154, pl. ii, f. 7; pl. iv, f. 3, 8, 12, 20; pl. v, f. 4. D.F.A.R.

Shell slightly exserted globose, thin, smooth, semi-transparent, usually uniform yellow-brown, interior nacreous, peristome white and glossy. Spire about  $\frac{3}{5}$ ths length of aperture, apex very blunt. Whorls  $4\frac{1}{2}$ , convex, all but the apical covered with very faint, close, regular, straight transverse striae and rather faint, irregular malleation, with occasional traces of close microscopic spiral sculpture; suture well defined. Aperture ovate, peristome narrowly reflexed, outer lip making with body whorl an angle of about  $112^\circ$ , callus faint; columella erect, slightly concave, margin rather broadly reflexed, almost concealing the narrow umbilicus. The shell described measures

Diam. maj. 24.9; alt. 26.3; apert. alt. 16.1, lat. 13.4; ends of peristome apart 11.7 mm.

Jaw thin, yellow-brown; radula 6 × 3 mm., central and inner laterals with rather narrow median cusps, formula  $(53+1+55) \times 114$ . Roof of mantle cavity conspicuously mottled with black, unlike any of the preceding high-spired species of which the animal has been examined.

Hab. LITTLE NAMAQUALAND. Springbok (type, Péringuey); Muishond; Mesklip; Kamaggas (Schultze); Quaggafontein; Ookiep; Wilde Paards Hoek; hills west of Groen Kloof (Rogers); Koubiskoberg (Frames).

CAPE PROVINCE. Bitterfontein, Van Rhynsdorp Dist.; Klein Vlei (per Miss E. Godman).

The series from the last three localities contains examples considerably smaller than type, ranging down to  $19.8 \times 19.5$  mm. in height and breadth in the set from Klein Vlei and 17.8 × 15.3 in that from Koubiskoberg, but the form of the shell remains normal.

# var. procerus Conn.

1912. Trigonephrus gypsinus M. & P. (pars), Conn., Ann. S.A. Mus., xi, p. 155. L.

1915. Trigonephrus namaquensis M. & P., var. procerus Conn., ibid., xiii, p. 155, pl. ii, f. 8, 9. D.F.

1933. Trigonephrus namaguensis procerus Conn., Pilsb. & Ckll., P.Z.S., p. 365. L.

Narrower than type, outer lip making with body whorl an angle of 124°, thus imparting to the aperture the drooping appearance of that of T. globulus. Alt. 22·8, diam. 19·0; apert. alt. 12·7, lat. 9·0; ends of peristome apart 6·5 mm.

Hab. LITTLE NAMAQUALAND (type); Ookiep (Lightfoot); Buffels River (Rogers); Steinkopf (per de Villiers).

CAPE PROVINCE. Van Rhyns Pass, Van Rhynsdorp Dist. (Cockerell).

Examples probably attributable to this variety have also been collected at Clanwilliam, Areb, and Kangnas.

Type in coll. Bryant Walker.

# Trigonephrus latezonatus Conn.

1929. Trigonephrus latezonatus Conn., Ann. Natal Mus., vi, p. 229, pl. xiv, f. 22. D.F.

Somewhat similar in form to namaquensis, but the coloration is deep buff with a broad peripheral band of dark chestnut, extending to the apex above the

suture on the earlier whorls, peristome and umbilical region white. Whorls 5, convex, first  $1\frac{1}{2}$  practically smooth, remainder sculptured with close, straight transverse striae, which are weaker and less regular on the last 2 whorls, and faint traces of spiral engraving on the last; suture well defined. Aperture nearly circular, outer lip making with body whorl an angle of 148°, peristome white, glossy, thickened and slightly reflexed, columella short, erect, margin very narrowly reflexed, but almost concealing the umbilicus.

Diam. maj. 20·2, min. 18·4; alt. 25·8; apert. alt. 12·6, lat. 10·0; ends of peristome apart 7·9 mm., other specimens varying from  $23\cdot2\times27\cdot7$  to  $17\cdot5\times21\cdot7$  mm.

in diameter and altitude respectively.

Hab. CAPE PROVINCE. Van Rhynsdorp (Frames).

Type in British Museum.

The shell is comparatively higher and the whorls more erect than in *namaquensis* typica, and the beautiful colour scheme, with broad chestnut band, quite distinctive.

## FAMILY BULIMULIDAE.

Shell usually well developed, lung with the smaller veins opening into a single long main vessel; kidney triangular, no longer than pericardium, with reflexed ureter, of which the secondary portion is usually closed; jaw usually with parallel or convergent plates or folds; radula diversified; genitalia usually without special appendages.

Genus Prestonella Conn., 1929 (Ann. Natal Mus., vi, p. 232). Type Buliminus bowkeri Sow.

Shell rather small, succineaeform, thin, smooth, corneous, spire moderately produced, peristome simple, acute; anatomy not yet published.

Prestonella bowkeri (Sow.). (Pl. ix, f. 25, 29, and text-fig. 24.) Ref. List No. 304.

1889. Buliminus (Mesembrinus?) bowkeri Sow., P.Z.S., p. 581, pl. lvi, f. 5. D.F.

Shell of fair size, succineaeform, rimate, smooth, thin, dull, corneous yellow-brown, usually obscured to some extent by an appearance of powdered grey. Spire produced, sides regular, scarcely convex, apex mamillate. Whorls 5, rapidly increasing, little convex, rounded at periphery, 1st minute, smooth, remainder sculptured with microspiral grooves, which become gradually wider apart and after the 2nd cross the weak, close, nearly straight, slightly oblique growth lines; all this spiral sculpture, however, is extremely evanescent and apt to disappear completely from the surface of full-grown shells; suture simple, well defined. Aperture acuminate ovate, well rounded at base, peristome simple, labrum straight and receding but little in profile, columella erect, little concave, margin extremely

narrowly but closely reflexed, sometimes completely obliterating the minute rima.

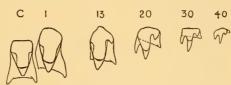
Alt. 19·2, lat. 10·4; apert. alt. 11·1, lat. 6·8; last whorl  $16\cdot 2$  mm., but the shell is frequently of rather more slender contour.

Hab. CAPE PROVINCE. Glenavon Falls, Somerset East (Miss Bowker).

Type set in British Museum.

Jaw arcuate, about 1.7 mm. wide, composed of about 18 irregular

radial laminae; radula (text-fig. 24) measures about  $4 \times 1.2$  mm. when flattened, formula  $(45 + 1 + 45) \times 160 + n$ ; central and admedians with simple cones; an ectocone appears in line 13 of the laterals and an endocone



Text-fig. 24.—Prestonella bowkeri (Sow.), Somerset East.

Representative teeth from radula; ×400.

in line 15; from here outwards the teeth are tricuspid, diminishing in size, outermost rudimentary.

# Prestonella nuptialis (M. & P.). Ref. List No. 322.

1894. Buliminus nuptialis M. & P., A.M.N.H., xiv, p. 92, pl. i, f. 5. D.F.

Smaller than the foregoing, corneous yellow-brown, with more convex whorls, of which there are 4, sculptured after the 1st with straight, regular, slightly oblique growth riblets, varying a little in strength, and hardly a vestige of microspiral grooving; other features as in bowkeri.

Alt. 16.0, lat. 8.1; apert. alt. 9.5, lat. 5.9; last whorl 13.5 mm.

Hab. CAPE PROVINCE. Craigie Burn, Somerset East (type, Mrs. Barber); Elandsberg Mountain, Cradock (Farquhar).

Type in British Museum.

# Prestonella quadingensis Conn.

1929. Prestonella quadingensis Conn., Ann. Natal Mus., vi, p. 233, pl. xiv, f. 25.  $\,D.F.$ 

Closely resembles the last species, from which it differs in very slightly more obese contour and its sculpture, which consists after the first  $1\frac{1}{2}$  whorl of fairly close, strong, straight growth lines crossed by weaker, much closer, microspiral ridgelets. The type, with 4 convex whorls, measures

Alt. 12.3, lat. 7.3; apert. alt. 7.2, lat. 4.6; last whorl 10.5 mm.

Hab. BASUTOLAND. Quthing (Ford).

Type in Albany Museum.

#### FAMILY ACHATINIDAE.

Holopod sigurethrous snails with central tooth of radula usually very narrow, its cusp small or absent, side teeth tricuspid or bicuspid, jaw generally striated; genitalia with few accessory organs, kidney with secondary ureter, pulmonary vein without large branches. Shell more or less ovate or slender, well developed and capable of containing the entire animal; peristome usually simple, columella often truncate.

# Subfamily ACHATININAE.

Shells ranging from small medium to very large, including the largest known land snails, ovate or turrited, whorls usually more or less brightly decorated with transverse flames and without internal lamellae. Sculpture almost invariably noticeable for more or less prominent granulation, produced by the intersection of transverse striae and spiral grooves, which usually commences about the second (seldom the apical) whorl and continues fairly strong above the periphery to the outer lip, but on the lower half of the shell the spirals frequently weaken and sometimes almost disappear, causing the surface to be far more glossy than on the upper half.

Genus Metachatina Pilsb., 1904
(Manual, xvi, p. 307).
Type Bulimus kraussi Pfr.
Large shells without columellar truncation.

Metachatina kraussi (Pfr.).

(Text-fig. 25.) Ref. List No. 365.

1846. Bulimus kraussi Pfr., Symb., iii, p. 85. D.

1848. ,<br/>, , , , , Krs., Südafr. Moll., p. 78, pl. v, f. 4. D.F.

1860. Achatina fuscolabris Mts., Die Helic., pp. 202, 204. N.

Shell large, acuminate ovate, perforate, fairly solid, dull, rugose, translucent, cream with chestnut flames and patches on the upper portion of the earlier whorls, ceasing abruptly at the periphery, interior whitish, with a conspicuous glossy brown band inside the aperture and colouring the columellar and parietal region. Spire moderately produced, sides straight and regular, apex rather narrowly rounded. Whorls 7, nearly flat, covered with very close and fine criss-cross sculpture of the usual Achatinid pattern, extremely faint below periphery of last whorl, which bears strong, wide, vertical riblets; suture simple. Aperture broadly acuminate ovate, peristome slightly thickened, labrum straight and nearly vertical

in profile, columella erect, margin strongly, though not broadly, reflexed for its entire length over the very narrow umbilicus.

Alt. 103, lat. 60; apert. alt. 52, lat. 35; last whorl 78 mm.

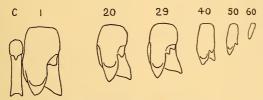
Hab. NATAL. Natal Bay (Krauss; Penther); Port Natal (Cato); woods near the Umlaas River (fide Pfeiffer); Tongaat; Kelso Junction (Burnup).

ZULULAND (Toppin); Mfongosi (Jones); Gingindhlovo (Miss Hickey); Sihangwana Bush (Bell Marley).

Type in Stuttgart Museum.

Two animals from Zululand are yellowish grey on the body, head and neck dark grey, with a broad pale streak on each side, extending from base of upper tentacles, lower part of body and tail yellowish grey.

A radula from Durban (Burnup) in the Gwatkin collection measures 16 × 8 mm. when flattened; it has 130 rows of teeth fully developed,



Text-fig. 25.—Metachatina kraussi (Rve.), Durban. Teeth from radula;

formula 65+1+65. Central narrow with small cone and long base; admedians large with a blunt ectocone and a slight swelling in place of an endocone; the first 3 laterals resemble the admedians but diminish in size; most of the remaining teeth are simpler in form with parallel sides, and outermost marginals are rudimentary. In the specimen figured No. 29 is abnormal in having a double ectocone.

The radula resembles that of Burtoa in having ectocones on all except the outermost teeth, but the central is rather larger, and in specimens examined there are not the numerous lines of abnormal teeth so prevalent in Burtoa.

# var. elongata Junod.

1899. Livinhacia kraussi Pfr., var. elongata Junod, Bull. Soc. Vaudoise, xxxv, p. 279. N.

1925. Metachatina kraussi Pfr., var. elongata Junod, Conn., Trans. R. Soc. S. Africa, xii, p. 165. D.

Persistently more elongate in comparison than the type; an average adult shell measures 145 × 72 mm. in length and breadth.

Hab. LORENZO MARQUES. Rikatla (type, Junod); Delagoa Bay (Barnard).

Type in Neuchatel Museum.

var. planti Pfr. Ref. List No. 365.

1861. Achatina planti Pfr., P.Z.S., p. 25, pl. iii, f. 6. D.F.

Were it not that this may be merely a monstrosity, it would be fully entitled to specific rank. The shell is imperforate, longer and far more slender than type, the aperture naturally longer and narrower, and columella almost truncate at base, without any marginal reflexion; spire elongate with very slightly convex sides, 8 flattish whorls, with extremely strong ribbing on the last 2, and the shell measures

Alt. 129, lat. 49; apert. alt. 63, lat. 28.5; last whorl 93 mm.

Hab. NATAL. Cape Natal (Plant). ZULULAND. Kosi Bay (?) (Toppin).

Type in British Museum.

The type shows a bad fracture about the 6th whorl, which may account for the peculiar elongation and attenuation of those subsequent to it, but even up to the point of fracture the shell was considerably narrower than *kraussi* at the same stage of growth, so the fracture may not be entirely responsible for the vast difference between the two forms.

Genus Burtoa Bgt., 1889 (Moll. Afr. Équat., March 1889, p. 88). (=Livinhacia Crosse, April 1889). Type Bulimus niloticus Pfr.

Large, somewhat solid shells of obese contour, creamy white under a thin brown epidermis, distinct from *Achatina* in that the columella is not basally truncate, and has its margin reflexed to form a well-defined rima. There appears to be only one actual species, varying considerably in form and comprising many varietal names.

Burtoa nilotica (Pfr.).
var. arnoldi Stur.
(Text-fig. 26.)
Ref. List No. 366 (pars).

1898. Livinhacia arnoldi Stur., S.A. Moll., p. 59, pl. ii, f. 41. D.F.

Shell very large, rimate, acuminate ovate, solid, nearly smooth, almost invariably found, even in live condition, devoid of epidermis, when the coloration is

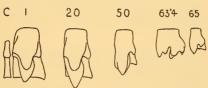
nearly uniform cream or pale buff, with a beautiful band of bright rose around the inner margin of aperture and up the columella, broadly diffused over the entire paries. I have, however, seen on one example traces of a thin dark brown periostracum, which probably covers the shell before weathering, resembling in this respect the more northerly races. The spire is broadly conoid, apical angle nearly 90°, apex very small, broadly subacute; whorls  $6\frac{1}{2}$ , moderately convex, rapidly increasing, the earlier practically smooth, later showing the granulation typical of the subfamily above the periphery, below which there are fairly strong, very close vertical striae with little or no spiral sculpture. Aperture subovate, peristome slightly thickened, labrum vertical and nearly straight in profile, columella straight, erect, margin narrowly triangularly reflexed over the rima; callus pink and continuous. The shell described measures

Alt. 109, lat. 71; apert. alt. 67, lat. (extern.) 46; last whorl 87 mm.

Hab. S. RHODESIA. Near the Amanze Inyama River (type, Penther); Salisbury (Oakley); Insiza (French); Victoria Falls (Soper); Sawmills; Nyamandhlovu (Arnold); Battlefields (Parkinson); Umtali (Kidwell); Omvuma (Miss Smith); Zimbabwe; Shangani (Williamson). Type in Vienna Museum.

Fairly common in Northern Rhodesia; Watson and Peile report that there is no special feature in the anatomy or radula to suggest

specific distinction from some of the northern races. The radula (text-fig. 26) of a specimen from Broken Hill measures  $16 \times 9$  mm. when flattened out, formula  $(83 + 1 + 83) \times 110 + \text{nascent}$ , outermost 5 lines of marginals very small and almost indistin-



Text-fig. 26.—Burtoa nilotica (Pfr.) var. arnoldi Stur.

Representative teeth from radula; ×115.

guishable. The first lateral appears tricuspid, though the inner process does not appear to be a true endocone, but rather a form of swelling which disappears in the adjacent lines. Many of the lines of marginals are united in pairs, notably 59–60, 61–62, and 63–64, as in text-figure; judging from many radulae examined, such doublings, with other malformations, are frequent in this genus.

Genus Achatina Lam., 1799 (Mém. Soc. Hist. Nat. Paris, p. 75). (=Cochlitoma Fér., 1821, Urceus (Klein) Jouss., 1884 and Parachatina, Serpaea and Pintoa Bgt., 1889).

Type Bulla achatina Lin.

Shell small medium to very large, acuminate ovate, turrited, or rarely subcylindric, imperforate, columella more or less prominently truncate at its base.

## (i) Group of zebra Brug.

Shell medium to very large, with comparatively fine apex and almost smooth body whorl.

Achatina zebra (Brug.). Ref. List Nos. 406, 407.

1789. Bulimus zebra Brug., Enc. Méth. Vers., i, p. 357. D.

1837. Achatina borniana Beck., Index Moll., p. 75. Emend. nom.

1842. ,, chemnitziana Pfr., Symb., ii, p. 132. Emend.

1851. ,, zebra Lam., Desh., Hist. Nat. Moll., ii, 2, p. 156, pl. exxxiii. D.F.

1860. Achatina capensis Albers, Mts., Die Helic., p. 203. N.

1900. ,, zebrula Mts., Sitz.-Ber. Ges. Nat. Fr. Berlin, p. 118. D.

1904–5. Cochlitoma zebra Brug., Pilsb., Manual, xvii, p. 85, pl. xxviii, f. 39; pl. lxiv, f. 67. D.F. Embryo.

1917. Cochlitoma zebra Brug., Standen, J. of C., xv, p. 160. Eggs.

1937. Achatina (Cochlitoma) zebra Brug., Peile, Proc. Mal. Soc., xxii, p. 189. R.

Shell very large, acuminate ovate, fairly solid, translucent, smooth and glossy, typically white or pale buff with close, fairly regular, vertical dark brown stripes, often broad on the penultimate, but narrow on the last whorl and about as wide as the intervals between them; interior and columella bluish white. Spire more or less produced, sides straight and regular, apex narrowly rounded. Whorls 8, not very convex, apical practically smooth, remainder sculptured above periphery with very fine, close criss-cross of the usual pattern, which becomes much weaker on the last whorl or so and practically disappears on the lower half; suture simple, well defined. Aperture acuminate ovate, labrum straight and nearly vertical in profile, columella long, straight or concave, callus very thin. Three large examples from the Cuming collection measure respectively

Alt. 144, lat. 63·5; apert. alt. 73·0, lat. 38·0; last whorl 105·5 mm. (8 whorls). ,, 119 ,, 63·0 ,, 68·5 ,, 34·5 ,, 94·0 ,,  $(7\frac{1}{2})$  ,

Hab. CAPE PROVINCE (capensis in coll. Albers); Caffraria (borniana, fide Beck); widely diffused near the south coast from the George and Knysna districts to East London and Pirie Forest and inland to Alicedale and Grahamstown, but not apparently ranging far outside these limits, while some records of its occurrence may uncertain, owing to confusion with varicosa Pfr.

CAPE PENINSULA. Camps Bay (Dale; Morris; doubtless introduced).

In its typical form this huge species, with some of its varieties is easily recognised by its straight-sided spire, fine apex and close,

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narrow striping, but it varies very greatly in contour, so that more than one unnecessary name has been based on mere variation in this respect.

There appears to be no object in retaining zebrula Mts. even as a variety; it was founded on a set of nine smallish examples obtained by Dr. Wilms "Between Delagoa and Lydenburg," but probably near the latter locality. There is no other record of zebra's occurrence in the Transvaal or P.E.A., nor any proof that these shells were collected alive. A lot of trade in curios is carried on and false information supplied by itinerant natives in those districts, and I think it may be inferred with reasonable certainty that Wilms' specimens were purchased in this manner and the locality in which the transaction took place erroneously attributed to them; such as I have examined are simply immature specimens of typical zebra, falling well within its limits of contour.

#### var. obesa Pfr.

# Ref. List No. 406 (pars).

1851. *Helix zebra* Fér., Desh., Hist. Moll., pl. cxxxiii, middle figure. *F*.

1854. Achatina obesa Pfr., Mal. Blätt., i, p. 224. D.

1904-5. Cochlitoma zebra Fér., var. obesa Pfr., Pilsb., Manual, xvii, p. 87, pl. xxvii, f. 35. D.F.

1921. Cochlitoma zebra Brug., var. obesa Pfr., Robson, P.Z.S., p. 250. A.R.

1921. Cochlitoma zebra Brug., var. obesa Pfr., Longst., P.Z.S., p. 379, pl. i, f. 1-4; pl. ii, f. 1-8; pl. iii, f. 1. F., Eggs; Ecology.

A short compact form with similar sculpture and usually similar coloration, close narrow dark stripes on buff or white ground, to the type. Pilsbry figures a shell with 7 flattish whorls which measures

Alt. 116, lat. 70; apert. alt. 66, lat. 39; last whorl 93 mm., which will be seen to be only 7 mm. broader than the second specimen cited in my description of the type form, and proves that there is not very much in varietal distinction; as might be expected in such an obese shell, the columella is particularly concave.

Hab. CAPE PROVINCE. Port Elizabeth District (Crawford; Mrs. Longstaff).

Originally described as from West Africa.

Type in Stettin Museum.

Animal lead grey or dirty yellow with darker reticulation and three dark stripes down head with pale grey ones between, or ground colour sometimes pale lemon yellow without reticulation; the anatomy was set forth by Robson in 1921.

var. fulgurata Pfr. Ref. List No. 406 (pars).

1851. Achatina fulgurata Pfr., P.Z.S., p. 258. D

1921. ,, zebra Brug., var. fulgurata Pfr., Robson, P.Z.S., p. 258. A.R.

1921. Achatina zebra Brug., var. fulgurata Pfr., Longst., P.Z.S., p. 379, pl. i, f. 5-13; pl. iii, f. 2. F., Eggs; Ecology.

Similar to type in form and sculpture, but with possibly slightly broader apex and much bolder colour scheme, the vertical brown and cream flames wider and shaped like forked lightning the entire length of the whorl. The half-grown type is said to hail from West Africa, but represents a common South African form, of which a well-grown example with  $7\frac{1}{4}$  whorls measures

Alt. 113, lat. 56; apert. alt. 62, lat. 31.5; last whorl 88 mm.

Hab. CAPE PROVINCE. Somerset East (Miss Bowker); Grahamstown; Kowie (Farquhar); Dunbrody; Keurbooms R. (Hewitt); Keiskamma Hoek (O'Connor); Red House, Port Elizabeth (Murray); East London (Swan).

Type in British Museum.

Animal pale greenish or yellowish grey, with darker reticulation, and three almost black stripes running down the head, with a yellow one on each side of the centre. Anatomy fully discussed by Robson in 1921.

var. kraussi Rve. Ref. List No. 406 (pars).

1842. Achatina kransii Rve., P.Z.S., p. 55. D.

1849. ,, kraussi Rve., Conch. Icon., pl. vi, f. 21. D.F.

Similar in form to type, but with a more solid shell, far weaker sculpture, and a ground colour of dark chestnut brown with broad white flames, few in number, on the last whorl or two, and seldom extending below the periphery. A large example with 7 whorls measures

Alt. 110, lat. 57; apert. alt. 58, lat. 33; last whorl 83 mm.

Hab. CAPE PROVINCE. Coega R., Algoa Bay (type, Krauss); Red House, Port Elizabeth (Murray); Kaaimans R., George (Truter). Type in British Museum.

Reeve's original name and locality, Cape Natal, are incorrect; Crawford wrote me: "I consider this a species, and have not seen it from anywhere else than Coega." Knowledge of the anatomy is necessary to elucidate the exact status of this well-characterised form, which may best, perhaps, be left among the varieties of *zebra*, where M. & P. placed it, until that comes to hand.

## Achatina varicosa Pfr.

#### Ref. List No. 404.

1861. Achatina varicosa Pfr., Mal. Blätt., viii, p. 73, pl. ii, f. 7-8. D.F.

1904-5. Cochlitoma varicosa Pfr., Pilsb., Manual, xvii, p. 92, pl. xxvi, f. 30-33. D.F.

1917. Cochlitoma varicosa Pfr., Standen, J. of C., xv, p. 161. Eggs.

The contour differs slightly from that of zebra in the sides being very slightly convex, giving the shell a rather different appearance. The typical colour pattern is strikingly handsome, a buff ground lightning-streaked with broad black-brown flames about equal in breadth to the space between them and showing plainly through the opalescent interior; columella white, straight or concave according to contour, which varies greatly. Pfeiffer, who first described the species from young shells which were then considered mature, afterwards received far larger examples, which he said imparted quite a different impression, being comparatively more elongate and slender than in immature state, but this does not always apply, as the mature shell often retains its youthful obesity, as exemplified in one from Resolution with 7 whorls and measuring

Alt. 80, lat. 48.5; apert. alt. 48, lat. 28; last whorl 65 mm., while a slightly

longer example figured by Pilsbry (after Pfeiffer) measures

Alt. 87, lat. 47; apert. alt. 49, lat. 26; last whorl 69 mm., the difference in contour being very noticeable.

To the slender form I must attach a race which has been long established about East London and practically coincides with Pfeiffer's figure, but differs in the colour scheme being far more commonplace, narrow and much less violent fulguration, which is sometimes hardly noticeable, on the striped specimens, while others, in fewer numbers, are of uniform yellow hue.

The animal of this race is dark greenish grey, with 2 narrow yellow stripes extending from the lower tentacles, past the upper, down the back; the broad dark stripe down middle of back extends to the tentacles, whereas in fulgurata it does not do so. The eggs are oval, one that I have measured being 8 × 5 mm., but this is no criterion of the average size, as the eggs of Achatina vary enormously in size in the crop of a single individual.

Two East London shells, with  $6\frac{1}{2}$  not very convex whorls, measure

Alt. 73.0, lat. 40.0; apert. alt. 41.5, lat. 21.0; last whorl 47 mm.

,, 78.0 ,, 40.0 ,, 42.0 ,, 22.0 ,, 51 ,,

and two all yellow from Kidds Beach, 21 miles from East London, with 6 whorls,

Alt. 64.0, lat. 35.0; apert. alt. 36.5, lat. 19.5; last whorl 50.0 mm. ,, 59.0 ,, 34.0 ,, 35.0 ,, 19.0 ,,

while a large example from Somerset East District (Miss Bowker) doubtfully assigned to this species is

Alt. 91.0, lat. 45.0; apert. alt. 47.0, lat. 25.0; last whorl 57.0 mm.

Hab. CAPE PROVINCE. Enon, north of Port Elizabeth (type, Hartwig); Grahamstown; Fish River (Farquhar); Resolution, Fort Brown (Miss A. Walton); East London to Kidds Beach (frequent) and fossil in aeolian conglomerate (Rattray); Port St. John's; Kwelegha Mouth (Power); Kingwilliamstown (Shortridge).

BECHUANALAND. Taungs (collected with the Taungs skull in fossil condition).

Achatina linterae Sow.

Ref. List No. 384.

1889. Achatina linterae Sow., P.Z.S., p. 580, pl. lvi, f. 11. D.F.

Probably a mere colour variety of the less slender form of zebra, which it resembles in size, shape, and sculpture; the ground colour is bright buff, with numerous darker vertical lines of growth, while commencing on the 3rd whorl is a spiral sequence of large red-brown spots of somewhat irregular size, encircling the upper part of each whorl exactly half-way between sutures; interior and columella opalescent with a narrow dark fringe to the peristome; columella erect, long, straight, and narrow. The type contains  $7\frac{1}{2}$  moderately convex whorls and measures

Alt. 87, lat. 50; apert. alt. 45, lat. 30; last whorl 65 mm.

Hab. CAPE PROVINCE. Port Elizabeth ("in drift sand; extinct," Crawford).

Type in Exeter Museum.

The position of the dotted girdle, well above the suture, is remarkable, and an original in my collection is in such fresh condition that its discontinuous pattern can scarcely be attributed to weathering.

# (ii) Group of ustulata Lam.

The main characteristics of this group are the comparatively smooth, glossy shell and the large, obtuse apex; A. ustulata is by far the largest member, none of the others exceeding medium length. The main colour scheme throughout consists of irregular chestnut flames on a buff ground; the columella is uncoloured and the granulation, while never strong, is frequently absent from the last whorl.

Achatina ustulata Lam.

(Pl. x, f. 3.)

Ref. List Nos. 394, 403.

1821. Helix (Cochlitoma) ustulata Lam., Fér., Tabl. Moll., pt. 3, p. 74 (or 70). N.

1822. Achatina ustulata Lam., Hist. Nat. An. s. Vert., vi, 2, p. 130. D.

1898. Achatina rhabdota M. & P., A.M.N.H., i, p. 29, pl. viii, f. 11. D.F.

Shell comparatively large, subulate, imperforate, rather thin, smooth, glossy, translucent, deep buff, with rather broad and irregular dark brown vertical flames, about twice as wide, for the most part, as the buff space between them, columella, callus, and interior bluish white, the dark flames showing clearly through the shell. Spire much produced, sides scarcely convex, apex broadly rounded. Whorls 7, not very convex, regularly increasing, the usual criss-cross sculpture exceedingly fine and close, though clear and regular, above the periphery till about the 6th whorl, where it weakens considerably, and practically absent from the lower part of the whorls, which are vertically striate and very glossy; suture simple, shallow. Aperture acuminate ovate, peristome simple, acute, labrum practically vertical in profile, columella straight and narrow, sharply truncate near the base, callus thin, usually not extending across the paries.

Alt. 85, lat. 32; apert. alt. 37, lat. 19; last whorl 57 mm.

Achatina rhabdota M. & P. is nothing more than a half-grown ustulata; the type

Alt. 44.5, lat. 22; apert. alt. 22, lat. 12; last whorl 33 mm.

Hab. Unknown to Lamarck or Férussac.

CAPE PROVINCE. George District (Krauss); Knysna (Farquhar; Crawford); Pondoland (Beyrich); Keurbooms R. bush (Barnard): Forest Hill (Newdigate).

NATAL. Durban (?) (Penther, fide Sturany)

"SOUTH AFRICA" (rhabdota, fide M. & P.).

LITTLE NAMAQUALAND. Port Nolloth (?) (rhabdota, in coll. Watson).

Type of ustulata in Geneva, rhabdota in British Museum.

The animal of the Keurbooms River race is uniform grey.

## · Achatina machachensis Smith.

Ref. List No. 386.

1902. Achatina machachensis Smith, Proc. Mal. Soc., v, p. 169. D.F.

Closely resembles ustulata, but has more convex whorls and does not appear to exceed two-thirds of its length; the granulation is practically missing from the last 2 whorls. The type contains 61 whorls and measures

Alt. 57.5, lat. 31; apert. alt. 27.5, lat. 16.0; last whorl 44.5 mm., but the contour is variable, other examples measuring  $52 \times 27$ ,  $50 \times 27.5$ , and  $44 \times 23$  mm.

Mount Machacha (type, Crawshay); Hab. BASUTOLAND. Leribe (Vink); Maseru (E. Ford).

CAPE PROVINCE. Katherg (Hewitt).

ORANGE FREE STATE. Thaba N'chu (Miss Wilman).

Type in British Museum.

A beautiful living example with uniform buff shell has recently been collected by Hewitt near the type locality.

# $A chatina\ crawfordi\ {\bf Morel.}$

Ref. List No. 374.

1889. Achatina crawfordi Morel., J. de C., xxxvii, p. 8, pl. i, f. 3. D.F.

Shell of moderate size, subovate, thin, smooth, glossy, semi-transparent, pale buff with rather narrow, nearly vertical, dark chestnut flames, as distinct within as outside the shell. Spire comparatively short, sides slightly convex, apex broadly rounded. Whorls 6, rather rapidly increasing, moderately convex, rounded at periphery, the first 2 nearly smooth, remainder finely, but clearly, granulate above, but only extremely faintly so below the periphery; suture simple, slightly oblique. Aperture acuminate, labrum nearly straight and vertical in profile, columella narrow, slightly concave, rather narrowly but abruptly truncate  $3\frac{1}{2}$  mm. above the base; callus extremely thin.

Alt. (type) 55, lat. 30; apert. alt. 30, lat. 17; last whorl 43 mm.

Hab. CAPE PROVINCE. Middleton; Kleinpoort; Zuurberg; "along the mountains from Cookhouse to Mount Stewart, a range of nearly 100 miles" (Crawford); Bedford; Somerset East (Farquhar); Douglas (Miss Orpen).

Type in British Museum.

The shell is of much thinner texture than that of ustulata; Morelet's original locality, Port Elizabeth, is incorrect. A. oedigyra is almost certainly identical with this species.

# Achatina oedigyra M. & P. Ref. List No. 388.

1894. Achatina oedigyra M. & P., A.M.N.H., xiv, p. 92, pl. i, f. 7. D.F.

Nearly related to the foregoing, but with very convex whorls, which may be merely an individual peculiarity. The type is nearly uniform buff, the flames being so pale as scarcely to show, but the second specimen in the type set has the normal dark chestnut markings. These two shells each contain 6 whorls and measure respectively

Alt. 55, lat. 33; apert. alt. 31·5, lat. 19; last whorl 44 mm. , , 55 ,, 32 ,, 29·5 ,, 17 ,, 42 ,,

An example from Salisbury, apparently attributable to this species, is marked with narrower flames, contains 6 whorls, and measures

Alt. 50, lat. 30; apert. alt. 28, lat. 17; last whorl 38.5 mm.

Hab. CAPE PROVINCE. Craigie Burn, Somerset East (type); Boschberg (Mrs. Barber).

S. RHODESIA. Salisbury (in British Museum).

DAMARALAND. Omongongua, near Okahandja (Hoesch).

Type in British Museum.

#### Achatina cinnamomea M. & P.

Ref. List No. 372.

1894. Achatina cinnamomea M. & P., A.M.N.H., xiv, p. 92, pl. i, f. 6. D.F.

A short, obese form, usually deep buff with flames of pale chestnut, or uniform buff with darker growth lines, the granulation being very weak on the penultimate and almost absent from the last whorl. It is very constant in shape, a typical example with 6 whorls measuring

Alt. 55, lat. 33; apert. alt. 31, lat. 18; last whorl 45 mm.

Hab. TRANSVAAL. Standerton (type, Burnup; Connolly). ORANGE FREE STATE. Kopies (Connolly).

Type in British Museum.

The whorls are far less convex than in oedigyra; one of the Kopjes examples exhibits a broad pale chestnut band above the periphery, exactly similar to that of dimidiata, without any darker vertical stripes, but the narrower apex proves the series correctly assigned to the present species.

## Achatina livingstonei M. & P.

Ref. List No. 385.

1897. Achatina livingstonei M. & P., A.M.N.H., xix, p. 636, pl. xvii, f. 6. D.F.

Shell small, narrowly elongate ovate, smooth, glossy, pale buff with vertical chestnut flames, varying in form and breadth, but not usually broader than the intervals between. Spire produced, sides regular, apex rounded. Whorls 7, flattish, extremely finely and closely but not strongly granulate until the last 2, which are almost smooth except for vertical growth striae. Aperture short, subpyriform, columella short, white, erect and concave.

Alt. (type) 42, lat. 18; apert. alt. 16.8, lat. 9.2; last whorl 26.6 mm.

Hab. BECHUANALAND. Kuruman (type, Livingstone).

CAPE PROVINCE. Prieska (Gibbons); Buchu Berg, Hay District (Gould).

GRIQUALAND WEST. Campbell (Williams); Bees Hoek, Postmasburg (Mrs. Tredrea).

Type in British Museum.

A distinct little species, to which its regular contour imparts a more finished appearance than that of most South African forms.

# (iii) Group of dimidiata Smith.

Usually large shells with unusually broad apex; last whorl smooth and glossy.

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## Achatina dimidiata Smith.

Ref. List No. 376.

1878. Achatina dimidiata Smith, Q.J.C., i, p. 348. D.
1922. ,, ,, Conn., Proc. Mal. Soc., xv, p. 76.

L.

(The shell figured in Pilsbry's Manual under this name belongs to the next variety.)

Shell large, globose, smooth and glossy, deep olive-yellow, typically with a very broad chestnut band extending upward from the periphery nearly to the suture, the lines of demarcation, especially the lower, being very sharply defined; interior and columella bluish white. Sides of spire straight, apex broadly rounded. Whorls 7, moderately convex, sculptured above periphery with very fine criss-cross of the usual nature, which is very faint on the last whorl and almost absent below the periphery; callus very thin.

Smith gave the wrong diameter (39 mm.) for his type, which is actually 43.5 mm. in breadth, a circumstance which has naturally caused some confusion and accounts for Pilsbry having mistaken its typical form. There are actually two races inhabiting much the same districts, but between which I have not yet observed intermediates, agreeing in all particulars except contour, one being the obese dimidiata, of which the type measures

Alt. 80·0, lat. 43·5; apert. alt. 45·0, lat. 26·0; last whorl 62·3 mm., and two other specimens

Alt. 79·0, lat. 44·0; apert. alt. 47·6, lat. 25·0; last whorl 65·0 mm., 69·5, 40·4, 24·0, 23·0, 54·0,

Hab. TRANSVAAL. Lydenburg (type, Craven); Piet Retief (Crawshay); Pilgrims Rest (Coghill); Carolina (C. Horsbrugh); Shiluwane District (Junod).

NATAL. Majuba (Connolly); Vryheid (Puzey); Dundee (Miss Hickey).

(The record of Kopjes cited in my Reference List refers to cinnamomea M. & P.)

Type in British Museum.

The single example from Carolina shows no vestige of the chestnut band, but its contour is that of the present species, rather than that of burnupi, to which it was ascribed in my Reference List.

var. schencki Mts.

Ref. List No. 396.

1889. Achatina schencki Mts., Sitz.-Ber. Ges. Nat. Fr. Berlin, p. 164. D.

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1894. Achatina schencki Mts., Conch. Mitth., iii, 3, p. 8, pl. xliii (numbered in text and index xlv), f. 3. D.F.

1904. Cochlitoma schencki Mts., Pilsb., Manual, xvii, p. 96, pl. v, f. 1; pl. xxxii (as dimidiata), f. 6. D.F.

Differs from foregoing in nothing but more slender contour; a typical example with  $6\frac{1}{2}$  whorls from Pilgrims Rest measuring

Alt. 70·0, lat. 35·6; apert. alt. 38·0, lat. 20·5; last whorl 56·5 mm.

Hab. TRANSVAAL. Macmac (type, Schenck); Pilgrims Rest (Miss Wilman).

Type in Berlin Museum; 72 × 32 mm. in length and breadth.

While both forms often occur near the same locality I have seen no intermediates, and they are easily distinguished by their different contour.

# Achatina burnupi Smith.

Ref. List No. 370.

1890. Achatina burnupi Smith, A.M.N.H., vi, pp. 392, 393. D. 1904–5. Cochlitoma burnupi Smith, Pilsb., Manual, xvii, p. 97, pl. xxxii, f. 5. D.F.

A beautiful tawny yellow shell with slightly narrower apex than the last two and extremely glossy body whorl. The spire has regular sides, 7 convex whorls, first  $3\frac{1}{2}$  rosy buff in fresh examples, remainder tawny or olive yellow with occasional darker areas and growth lines; interior pale milky blue, columella white. A well-grown shell from Van Reenen measures

Alt. 72, lat. 36; apert. alt. 40, lat. 20; last whorl 56.5 mm.

Hab. NATAL. Van Reenen's Pass, Drakensberg (type), and Van Reenen (Burnup); Giant's Castle (Mann); Lowlands (Miss Hickey).

The record from Carolina in my Reference List refers to dimidiata. Type in British Museum.

# (iv) Group of natalensis Pfr.

Typically unicoloured yellow shells, differing in certain details of size and shape; most are but little known, and fuller acquaintance may establish relationship between some of them with better known flammate species.

Achatina natalensis Pfr.

(Pl. xi, f. 3.)

Ref. List No. 387.

1854. Achatina natalensis Pfr., P.Z.S., p. 294. D.

1925. ,, ,, ,, Conn., Trans. R. Soc. S. Africa, xii, p. 168. N.

Shell rather large, acuminate ovate, thin, smooth, glossy, pale yellow. Spire produced, sides regular, apex narrowly rounded. Whorls 8, moderately convex, regularly increasing, apex smooth, remainder sculptured above the periphery with extremely fine granulation, caused by the intersection of very fine, close, regular, vertical striolae and spiral lines, the latter lacking below the periphery; suture simple. Aperture subovate, rounded at base, peristome simple, acute, labrum very slightly curved and almost vertical in profile, columella rather short, narrowly but abruptly truncate slightly above the base of the shell, curved above and extending across the paries in a well-defined callus.

Alt. (type) 61, lat. 32; apert. alt. 32, lat. 18; last whorl 43.5 mm.

Hab. NATAL. Port Natal (type, Plant). LORENZO MARQUES. Delagoa Bay (Plant).

Type in British Museum.

Other localities from the Transvaal and Orange Free State recorded in my Reference List are probably incorrect; as I stated in 1925, the only authentic examples known to me are three, collected by Plant, in the British Museum, but the correctness of his localities is open to question.

The photograph here given will afford some idea of the appearance of this hitherto unfigured species.

Achatina churchilliana M. & P.

(Pl. xi, f. 5.)

Ref. List No. 371.

1895. Achatina churchilliana M. & P., A.M.N.H., xv, p. 164, pl. xii, f. 3. D.F.

Closely allied to *natalensis*, but with rather longer, less convex whorls and a slightly broader apex. All known examples are uniform yellow-buff, but in some this pales below the periphery, the line of demarcation being very distinct, as in A. dimidiata. The type contains 7 whorls and measures

Alt. 74, lat. 34·0; apert. alt. 35, lat. 18·5; last whorl 50·2 mm.

The transverse striation is fairly strong, especially on the last 2 whorls, but the spiral is rather weak, and almost absent from the last.

Hab. NATAL. Port Natal (type, Churchill; Grout; Miss Wheelwright, 1862); "Zulu Country" (J. Sanderson, 1861).

Type in Manchester Museum.

Achatina zuluensis sp. n.

(Pl. x, f. 2.)

Shell comparatively large, acuminate ovate, thin, nearly smooth, buff with rather narrow zigzag red-brown flames. Spire straight sided, apex narrowly rounded. Whorls 8, convex, with very fine, close granulate sculpture and a very smooth, glossy body whorl; columella narrow, only lightly truncate.

Alt. 75, lat. 40; apert. alt. 38, lat. 22; last whorl 54·7 mm. Two other specimens measure: alt. 67, lat. 37·5; apert. alt. 36·5, lat. 20; last whorl 50 mm.; and another more slender: alt. 68, lat. 32·2; apert. alt. 33, lat. 16·5; last whorl 46 mm., but the slender form is infrequent.

Hab. ZULULAND. Kosi Bay (type, Toppin, 1905); Maputa (A. C. V. Bell, 1927).

Type in British Museum.

A shell of very ordinary appearance, but with much weaker sculpture than other flammate species to which it might be referable, while *churchilliana* M. & P., to which it may be nearly allied, has a very slightly broader apex and all specimens I have seen are unicoloured yellow, while the columella is particularly short and thick and strongly truncate, points of no great magnitude but which taken together seem to indicate specific distinction. The new species differs from *craveni* Smith, which it resembles closely in form, in having far weaker sculpture and a less acute apex.

Despite the flammate colouring and narrower apex, the smooth sculpture and near affinity, especially of the narrower form, to *churchilliana* suggest its most suitable position in the same group as and following that species.

Achatina transvaalensis Smith.

(Pl. xi, f. 2.)

Ref. List No. 402.

1878. Achatina transvaalensis Smith, Q.J.C., i, p. 351. D.

Similar in colour and shell characters to *natalensis*, but so much shorter and comparatively more slender that it cannot be the young thereof. The type contains  $7\frac{1}{2}$  whorls and measures

Alt. 38, lat. 17.5; apert. alt. 17, lat. 9.5; last whorl 25.5 mm.

Hab. TRANSVAAL. East slope of Drakenfels, near Lydenburg (type, Craven); Barberton (Déglon).

Type in British Museum.

The shell is extremely delicate and fragile; it has not previously been illustrated.

Achatina simplex Smith.

Ref. List No. 399.

1878. Achatina simplex Smith, Q.J.C., i, p. 350. D.

A comparatively short, obese form, the bright amber or greenish-yellow epidermis occasionally showing faint, narrow streaks of pale chestnut in the lines of growth, interior pale bluish, columella white. 7 convex whorls, the usual granulate sculpture of moderate strength on the first 5, when the spiral becomes much

weaker, so that the later whorls are very glossy; columella rather short, erect, slightly concave.

Alt. (type) 50, lat. 28; apert. alt. 25.0, lat. 15.5; last whorl 36.5 mm.

Hab. NATAL. Port Natal (type, Sutherland, 1860); Tugela Valley (fide Quekett); Ladysmith; Weenen (Burnup); O.R.C. Junction Station (Connolly); Durban (Power).

ZULULAND. Mfongosi (Rump).

The type (in British Museum) possesses half a whorl more, and is therefore longer by nearly 10 mm. than the usual size of this species.

Burnup has noted that two eggs taken from the same shell of this species from Weenen measure respectively  $8.25 \times 6.33$  and  $5.0 \times 4.25$  mm., giving ratios of 76.77 and 85.0 per cent., and adds "If the egg determines the width of the apex, what value does the width have as a specific character?"

# Achatina parthenia M. & P.

Ref. List No. 390.

1903. Achatina parthenia M. & P., A.M.N.H., xii, p. 605, pl. xxxii, f. 10. D.F.

A small, glossy, yellow species, differing from simplex in its narrower form and from transvaalensis in its more convex whorls, of which there are  $7\frac{1}{2}$ , very convex, granulation very weak on the earlier and almost absent from the last. Alt. (type)  $37\cdot2$ , lat.  $17\cdot6$ ; apert. alt.  $15\cdot5$ , lat.  $8\cdot8$ ; last whorl  $23\cdot7$  mm.

Hab. ZULULAND. Lower Umfolosi Drift (type); Makowe (Burnup); Ubomba (Toppin).

Type in British Museum.

Achatina subcylindrica Prest.

(Pl. xi, f. 7.)

Ref. List No. 401.

1909. Achatina subcylindrica Prest., A.M.N.H., iii, p. 182, pl. vii, f. 8. D.F.

A narrow yellow shell with 8 convex whorls and considerably stronger granulation than *parthenia*, of which it might otherwise well be a large example. A specimen from Natal in my collection, far larger than the type, measures

Alt. 46.5, lat. 18.0; apert. alt. 15.0, lat. 9.0; last whorls 26.0 mm.

Hab. NATAL (fide Preston).

Type in Tervueren Museum.

Preston's figure and my own shell suggest abnormality, but if this is the case I have not yet been able to connect them with any known species.

# (v) Group of granulata Pfr.

Thin shells, with ground colour of deep buff, rarely unicoloured, commonly with numerous bright chestnut flames, the majority showing very strong granulation, in some cases all over, more usually fainter below the periphery, and sometimes almost lacking from the later whorls.

# (a) With broad, blunt apex.

A group of south-eastern species of which the exact inter-relationship is a matter of considerable uncertainty. I included drakensbergensis and semigranosa in my Reference List, on the authority of more experienced conchologists than myself, in the synonymy of granulata, but the twenty-five years that have elapsed since then have by no means confirmed that action, and it now appears the safer course to treat them as distinct species (albeit possibly mere varieties) until more is known about these Natalian races.

# Achatina granulata Pfr. Ref. List No. 379.

1852. Achatina granulata Pfr., P.Z.S., p. 66. D.

" Semp., Reis. im Arch. Philippin., ii, 3, p. 143, pl. xii, f. 2; pl. xvi, f. 14. A.R.

1899. Achatina schinziana Mouss., Junod, Bull. Soc. Vaudoise, xxxv, p. 278. L.

1917. Cochlitoma granulata Krs., Standen, J. of C., xv, p. 161. Eggs.

1925. Achatina granulata Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 168. N.

Shell very large, acuminate ovate, thin, rather dull, translucent, bright buff, with moderately close chestnut flames of very irregular pattern. Spire produced, sides very little or not at all convex, apex broadly rounded. Whorls 8-10, rapidly increasing, moderately convex, rounded at the periphery, sculptured from the extreme apex with fine, strong granulation, caused by the close transverse striae being intersected by spiral lines, which are equally close on the earliest, but slightly more distant on the later whorls, the granulation being nearly equally strong all over on mature, but rather weaker below the periphery on immature shells; suture usually simple, well defined. Aperture acuminate ovate, labrum slightly sinuous and nearly vertical in profile, columella concave, narrowly truncate at right angles near the base, nacreous, callus thin and almost colourless. A typical example in the British Museum measures

Alt. 127, lat. 60; apert. alt. 69, lat. 36; last whorl 93 mm.

Hab. NATAL (type in coll. Cuming); Durban (Bowker); all along the coast from Port Shepstone to Tugela and beyond into Zululand,

and at various inland localities as far as Van Reenen's Pass; common at Pietermaritzburg (Burnup and others).

CAPE PROVINCE. Pondoland (Beyrich).

LORENZO MARQUES. Cape Delagoa (Plant); Rikatla (Junod). Type in British Museum.

I showed in 1925 that Junod's record of *schinziana* from Rikatla was due to misidentification.

#### Achatina semidecussata Pfr.

Ref. List No. 398.

1846. Achatina semidecussata Mke., Pfr., Symb., iii, p. 91. D. 1860-3. Achatina semidecussata Mke., Pfr., Conch. Cab., p. 336, pl. xxvii, f. 2-3. D.F.

1917. Cochlitoma semidecussata Pfr., Standen, J. of C., xv, p. 161. Eggs.

(The shell illustrated in Pilsbry's Manual, pl. xxx, f. 53, is semi-granosa Pfr.)

Far more slender than preceding, with somewhat finer granulation above and practically none below the periphery, where the surface is glossy and vertically striate; the yellow background predominates in the colour scheme, the chestnut stripes, often interrupted or zigzag, being spaced rather far apart; columella white. Pfeiffer's figure depicts a very long narrow shell, with 8 convex whorls, rather broad summit, and unusually short aperture.

Alt. 73, lat. 30; apert. alt. 28, lat. ca 14.5; last whorl 43.7 mm.

An all yellow variety was collected at Durban by Puzey.

Hab. NATAL (type, Menke); Durban (Penther; Puzey); Tongaat; Port Shepstone (Burnup); Malvern (Miss Bowker); Table Mountain (Rump).

TRANSVAAL. Upper Olifants River, north of Middelburg (fide Martens).

Type in Stettin Museum.

# $A chatina\ pentheri\ {\rm Stur}.$

Ref. List No. 393.

1898. Achatina pentheri Stur., S.A. Moll., p. 56, pl. ii, f. 40. D.F.

Very near akin to the foregoing, but possibly a trifle more slender and not attaining quite the same dimensions; the sculpture is of similar pattern, but the rufous streaks in all examples that I have seen are considerably less spaced, about the width of the yellow area between them. It was founded on immature shells, of which my largest paratype measures

Alt. 39·0, lat. 17·5; apert. alt. 18·5, lat. 9·0; last whorl 25·2 mm.; but larger specimens in the British Museum measure

Alt. 62, lat. 22·5; apert. alt. 22, lat. 13; last whorl 40 mm. ,, 53 ,, 22 ,, 24 ,, 12 ,, 36 ,, ,, 50 ,, 19 ,, 20 ,, 9 ,, 31 ,,

and a shell of semidecussata 31 mm. in length has a breadth of 17 mm.

Hab. NATAL. Durban (type, Penther); Port Natal (G. C. Cato, 1857).

Type in Vienna Museum.

Achatina drakensbergensis M. & P.

Ref. List No. 379 (pars).

1897. Achatina drakensbergensis M. & P., A.M.N.H., xix, p. 636, pl. xvii, f. 7. D.F.

A much smoother, broader form than *semidecussata*, with unusually short concave columella; olive buff with a few short, vertical chestnut stripes and dots, which cease abruptly at the periphery, interior and columella bluish white. Spire straight sided, apex rather broadly rounded. Whorls 8, moderately convex, with clear and fine, but rather weak granulation above and extremely faint below periphery.

Alt. 81, lat. 37.5; apert. alt. 43, lat. 17.3; last whorl 58 mm.

Hab. NATAL. Inhluzani Spurs (type, Mrs. Shaw); Port Natal (Sutherland).

Type in British Museum.

I have described the type, but the authors mention a second specimen, not now available, but from their remarks probably not conspecific. One of Sutherland's shells is uniform ochre without red markings and only very few darker growth lines, while a second bleached example appears to have once borne rather distant, narrow rufous flames.

Achatina semigranosa Pfr.

Ref. List No. 379 (pars).

1861. Achatina semigranosa Pfr., P.Z.S., p. 25. D.

1890. ,, ,, ,, (as synonym of *granulata*), Smith, A.M.N.H., vi, p. 391. N.

1905. Achatina semidecussata Pfr., Pilsb., Manual, xvii, pl. xxx, f. 53. F.

A slender form, almost half-way between granulata and semidecussata, with the colour pattern of the latter, sparse chestnut flames and blotches on a yellow ground, and peculiarly strong superperipheral criss-cross sculpture, the deep spiral grooves possibly farther apart than in granulata, causing each nodule of malleation to stand out prominently. The type has  $7\frac{1}{2}$  convex whorls and measures

Alt. 77, lat. 35.5; apert. alt. 42.2, lat. 17.7; last whorl 54.6 mm.

Hab. NATAL. Cape Natal (type, Plant).

Type in British Museum.

Conspicuous for its extremely strong sculpture and gaudy colour scheme.

(b) With narrower apex.Achatina vestita Pfr.(Pl. x, f. 4-6.)Ref. List No. 405.

1854. Achatina vestita Pfr., Novit. Conch., i, p. 35, pl. ix, f. 8-9. D.F.

Shell large, turriform, thin, translucent, uniform buff or yellow-brown in the type set, but usually painted with broad, undulating, vertical chestnut flames. Spire produced, sides regular, apex rounded. Whorls 7½, nearly flat, regularly increasing, finely granulate, almost from the extreme apex, with fine, close, nearly vertical striolae, crossed by spiral lines, all of which is concealed on the 6th and later whorls by a thick cuticle, soft to the touch and recalling some crèpy fabric; this is uniform buff or brown, the chestnut flames, when present, just showing through it; suture crenulate, frequently oblique at the last whorl. Aperture elongate subovate, labrum but little curved, nearly straight and receding only slightly in profile, columella white, slightly concave, abruptly truncate at right angles at its base, callus almost absent.

Alt. (type) 73.5, lat. 33; apert. alt. 37, lat. 18; last whorl 51 mm.

A larger shell from Delagoa Bay measures 79 × 37 mm.

Hab. NATAL. Cape Natal (type, Plant).

ZULULAND. Kosi Bay (Toppin).

CAPE PROVINCE. Pondoland (Beyrich); Port St. John's (Shortridge; Puzey).

LORENZO MARQUES. Delagoa Bay (Plant).

Type in British Museum.

# (vi) Group of bisculpta Smith.

Thin shells of medium size, normally marked with the usual chestnut flames and bearing strong, fine criss-cross sculpture above the periphery.

Achatina bisculpta Smith. Ref. List No. 369.

1878. Achatina bisculpta Smith, Q.J.C., i, p. 349. D.

Shell of moderate size, acuminate ovate, imperforate, thin, glossy, transparent, pale greenish yellow with numerous narrow, nearly vertical chestnut flames, about 5ths the width of the space between them. Spire not greatly produced, sides hardly convex, apex narrowly rounded. Whorls 7, convex, rounded at the periphery, regularly increasing, the extreme apex (2 whorls) practically smooth, remainder covered with fine granulation above the periphery, whence it continues

to the base, but becomes much closer and finer, owing to the increasing number of spiral lines; suture simple, deep. Aperture suboval, peristome simple, acute, labrum receding but very slightly to the base, columella white, concave, abruptly truncate; callus extremely weak.

Alt. 47, lat. 27; apert. alt. 25, lat. 15; last whorl 36 mm.

Hab. "SOUTH AFRICA" (type, in British Museum).

TRANSVAAL. District north of Pretoria (Connolly); Pietersburg; Haenetsberg; Middelburg (in Kimberley Museum).

Type in British Museum.

A rather obese form, notable for the double system of granulation from which it derives its name.

## Achatina smithi Crvn.

Ref. List No. 400.

1880. Achatina smithi Crvn., P.Z.S., p. 617, pl. lvii, f. 1. D.F.

Very similar to bisculpta, but comparatively more slender, with very much weaker, though similar, sculpture, while in the type the columella is narrower and less abruptly truncate than in that species; it measures

Alt. 54, lat. 29; apert. alt. 29.5, lat. 14.5; last whorl 39 mm.

Hab. TRANSVAAL. Lydenburg (type, Barrett); Knoppies Kraal, 40 miles west of Warmbaths (Braine).

S. RHODESIA. Maitengue River (Penther); Matetsi (Stevenson). GRIQUALAND WEST. Boetsap, Barkly West; Rooi-Poort, Kimberley (Swan).

Type in British Museum.

# monstr. scaevola M. & P.

Ref. List No. 395.

1893. Achatina scaevola M. & P., A.M.N.H., xii, p. 104, pl. iii, f. 2. D.F.

Differs from *smithi* only in being sinistral and of greater size, due to the presence of an extra half-whorl.

Alt. 65, lat. 32; apert. alt. 33, lat. 17; last whorl 47 mm.

Hab. TRANSVAAL. Zoutpansberg (Bowker).

Type in British Museum.

Based on a single example from the district in which the group is mainly found, I can only regard this as a sinistral monstrosity of Craven's species, of which it reflects a very good representation when viewed in a mirror.

Achatina penestes M. & P.

(Pl. xi, f. 4.)

Ref. List No. 392.

1893. Achatina penestes M. & P., A.M.N.H., xii, p. 104, pl. iii, f. 3. D.F.

Very similar to *smithi*, if not merely a variety thereof. The sculpture is the same, and in some examples, in which the colour scheme consists of chestnut flames on a buff ground, I find it practically impossible to determine to which species they belong. The type, however, and all topotypes that I have seen are rather more slender than *smithi*, the chestnut flames are absent or almost invisible, but the epidermis is closely streaked with vertical lines of dark and pale buff. The largest topotype in my collection, a finer specimen than the type, contains 7 whorls and measures

Alt. 39.5, lat. 18.5; apert. alt. 20, lat. 9.5; last whorl 28 mm.

Hab. TRANSVAAL. Daspoort, Pretoria (type, Farquhar). Type in British Museum.

# Achatina connollyi Preston.

Ref. List No. 373.

1912. Achatina connollyi Prest., A.M.N.H., ix, p. 71, f. 5. D.F.

A far smoother and consequently more glossy shell than either of the foregoing, very constant in its close, narrow chestnut flames, about half as wide as the buff intervals, but rather variable in contour, three paratypes in my collection measuring Alt. 47.0, lat. 21.0; apert. alt. 21.5, lat. 10.5; last whorl 31 mm.

Hab. S. RHODESIA. Rain Forest, Victoria Falls (type, Connolly). Type in Tervueren Museum.

Achatina schinziana Mouss.

(Pl. x, f. 1.)

Ref. List No. 397.

1887. Achatina schinziana Mouss., J. de C., xxxv, p. 294, pl. xii, f. 3. D.F.

The shell photographed, from Ngamiland, practically coincides with Mousson's figure; it agrees with the type of bisculpta in every respect of contour, coloration, sculpture and convolution, except that it is larger, having an additional whorl, and that the chestnut flames, at least after the 5th whorl, are rather broader and more distant than in Smith's species. The fine granulation in fresh shells is very strong above the periphery, and present, though much fainter, beneath; labrum vertical and slightly curved forward in profile, columella erect, narrow, bluish white, nearly rectangularly truncate at the base of the shell.

Alt. 65·6, lat. 36·0; apert. alt. 37·0, lat. 16·9; last whorl 48·3 mm.

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Hab. OVAMBOLAND. Ondonga (type, Schinz); Sodanna, approx. 21° E., 19° S. (Passarge).

BRITISH BECHUANALAND. Maun, approx. 23° 45′ E., 20° S. (Hale Carpenter).

Type in Zurich Museum.

I proved in 1925 \* that Junod's record of this species from Rikatla refers to granulata Krs.

# var. degenerata O. Bttg.

1910. Achatina schinziana Mouss., var. degenerata Bttg., Abh. Senckenb. Ges. Frankfurt, xxxii, p. 447, pl. xxviii, f. 12. D.F.

Described as differing from the type in being  $\frac{1}{3}$ rd smaller, with a little more convex whorls, columella shorter, stronger, more sinuous and more distinctly truncate at base.

Alt. 49-61, lat. 28-35 mm.

Hab. BRITISH BECHUANALAND. Kakia, approx. 23° 45′ E., 24° 60′ S. (subfossil, Schultze).

Type in Senckenberg Museum.

Founded on specimens in poor condition, on which the chestnut flames, not shown in the author's villainous figure, are said to be narrower and more linear than in the type.

Judging from the above data, Böttger's variety must be very nearly, if not quite, identical with A. smithi Crvn., of which I have specimens agreeing with its dimensions.

# Achatina ampullacea O. Bttg.

Ref List No. 367.

1910. Achatina ampullacea Bttg., Abh. Senckenb. Ges., xxxii, p. 447, pl. xxviii, f. 13. D.F.

Said to differ from *schinziana* and *damarensis*, to which it is very near, by its more ventricose form and strong inflation of the last whorl. The sculpture is as in *schinziana*, and the rufous flames are nearly straight, not fulgurate;  $6\frac{1}{2}$  whorls, little convex; columella short, white, sigmoid, abruptly truncate near base of shell.

Alt. 51.0, lat. 34.0; apert. alt. 31.0, lat. 17.0; last whorl 40.0 mm.

Hab. BRITISH BECHUANALAND. Banks of the Epukiro-Omuramba, approx. 22° S., 15 km. from Komeduve, south of Lake Ngami (Hermann).

Type in Senckenberg Museum.

A single example, obviously very near schinziana.

\* Trans. R. Soc. S. Africa, xii, p. 168.

# Achatina passargei Mts.

## (Pl. xi, f. 1.)

## Ref. List No. 391.

1900. Achatina passargei Mts., Sitz.-Ber. Ges. Nat. Fr. Berlin, p. 119. D.

1904. Achatina passargei Mts., Die Kalahari, pp. 754, 755, f. 1. D.F.

Resembles *schinziana* in sculpture and coloration, but is far more slender, with less rapidly increasing whorls and consequently shorter aperture; the long, straight, narrow columella is alike in both species. The type is subfossil, but retains a certain amount of colour and sculpture, consists of 8 whorls, somewhat less convex than in *schinziana*, and measures

Alt. 61·7, lat. 30·5; apert. alt. 29·0, lat. 15·2; last whorl 42·6 mm.; the discrepancy between the author's measure of the width of aperture and my own is because he included the columella and I only the interior dimensions.

Hab. OVAMBOLAND. Sodanna, approx. 21° E., 19° S. (Passarge). Type in Berlin Museum.

The type is somewhat abnormal about the penultimate whorl, but gives a better idea of the species than the immature shell figured by Martens, which was presumably selected as being in more recent condition.

## Achatina craveni Smith.

## Ref. List Nos. 380, 383.

1880. Achatina kirkii Smith, A.M.N.H., vi, p. 428. D.

1881. , kirki Smith, Crosse, J. de C., xxix, p. 138. N.

1881. ,, craveni (=kirkii Smith, 1881, non Crvn. 1880), Smith, P.Z.S., p. 283, pl. xxxiii, f. 11. D.F.

1881. Achatina craveni Smith, Crosse, J. de C., xxix, p. 298. N.

1891. ,, ,, Mts., Sitz.-Ber. Ges. Nat.-Fr. Berlin, p. 14. D.

1897. Achatina craveni Smith, Mts., D.-O.-A., iv, p. 91. N.

1899. ,, ,, ,, P.Z.S., p. 590, pl. xxxv, f. 1–2. N.F.

1902. ,, ,, ,, Ancey, J. de C., l, p. 277. L.F.

1904. ,, ,, ,, Pilsb., Manual, xvii, p. 66, pl. vii,

f. 16–18. D.F.

1906. Achatina jacobi da Costa, Proc. Mal. Soc., vii, p. 11. D.F.

1912. ,, ,, and *greyi* da Costa, Conn., Ann. S.A. Mus., xi, pp. 195, 196. *Ref. List*.

1917. Achatina jacobi da Costa, Standen, J. of C., xv, p. 160. Egg.

1922. Achatina, ef. greyi da C., Conn., Proc. Mal. Soc., xv, p. 56. N.L.

1925. Achatina jacobi da C., Conn., Trans. R. Soc. S. Africa, xii, p. 168. N.

1932. Achatina jacobi da C., Peile, Proc. Mal. Soc., xx, p. 104. R. As the type of this variable species is so bleached and worn that the sculpture of the first 5 whorls has disappeared and little of the original colouring remains, I describe a shell from Marandellas which coincides as nearly as possible with it in shape and size.

The criss-cross sculpture in fresh shells is of the usual pattern, fine but very strong above the periphery of the earlier whorls, gradually weakening on the last one or two, and the spiral almost absent below periphery, where the vertical striation remains strong. The typical colour scheme is a ground of deep buff streaked with all shapes and sizes of dark red flames, about equal in breadth to the space between them, but often exhibiting different degrees of slope and interruption on every half-whorl of the same shell, but unicoloured bright yellow examples have been figured by Smith from Nyasaland and seen by myself from the Belgian Congo; the columella is whitish; spire normally with straight sides and fine apex; the type has 8 moderately convex whorls and measures

Alt. 81·0, lat. 37·0; apert. alt. 39·0, lat. 20·0; last whorl 59 mm., but the species varies greatly in width even in the same gathering, one of the broadest I have seen being  $85 \times 48$  mm.

Owing to the worn condition of the type I must admit misunderstanding the true nature of this species until recently; I pointed out in 1922 that the inclusion of *greyi* in my Reference List was erroneous, though not affecting the synonymy which accompanied it, but I was mistaken in stating in 1925 that *jacobi* has little in common with Smith's species; it is simply a very large example of the broader form mentioned above, measuring: alt. 105·0, lat. 54·0; apert. alt. 59·0, lat. 26·5; last whorl 75·5 mm.

Dr. Bequaert, to whom I am much indebted for kindly communicating to me his views on the South African Achatinidae, agrees in this synonymy.

Hab. TRANSVAAL. Sibasa (Junod).

S. RHODESIA. Rusape (jacobi, Morrell); Salisbury and district (common); Marandellas; El Dorado; Umtali (Kidwell); Battlefields (Parkinson); Shangani (A. Jones); Victoria (Miss Wilman); Matetsi (Stevenson).

LORENZO MARQUES. Macequece District (Cressy).

Types in British Museum.

Described from Tanganyika Territory and recorded from Nyasaland, N. Rhodesia, and the Belgian Congo.

#### Achatina dammarensis Pfr.

(Pl. x, f. 6.)

Ref. List Nos. 375, 397 (pars).

1870. Achatina dammarensis Pfr., Mal. Blätt., xvii, p. 31. D.

1870. ,, ,, Novit. Conch., iv, p. 2, pl. cix,

f. 3-4. D.F.

1904. Achatina dammarensis Pfr., Pilsb., Manual, xvii, p. 21, pl. xi, f. 32-33. D.F.

1922. Achatina damarensis Pfr., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., pp. 34–38. N.A.R.

1929. Achatina damarensis Pfr., Adens., Ann. Mus. Wien, xliii, p. 397. N.L.

1930. Achatina damarensis Pfr., Conn., Ann. S.A. Mus., xxix, p. 294. N.

Founded on an immature shell, dull above, smooth and glossy below the periphery, greenish yellow with sparse, narrow, irregular, vertical, pale red streaks. Sides of spire straight and regular, apex very narrowly rounded. Whorls  $6\frac{1}{2}$ , moderately convex, covered above periphery with very fine and close, but strong sculpture of the usual granular pattern, while the lower portion is almost devoid of spiral sculpture and the vertical is very weak; suture well defined; a typical specimen measured by Böttger was  $50\times27$ , apert.  $27\times15$  mm., and another in my collection is

Long. 36, lat. 21; apert. alt. 23.5, lat. 10.5; last whorl 29.5 mm.

While much broader than *smithi* Crvn., the shell is not quite so broad as *schinziana* or *bisculpta*, with slightly longer, and hence fewer whorls in equal length.

Hab. DAMARALAND (type, coll. Dohrn); Ubeb (Schenck); Omuramba-Omataka R., near Okosongoho; bank of Black Nosab near Gobabis (Hermann); Grootfontein; Omaruru; Farm Voigtsland, 26 km. east of Windhoek (Michaelsen); Okosongomingo, Little Waterberg (Thomsen); Okahandja (Fock); Omongongua, near Okahandja (Hoesch); Sandfontein, east of Windhoek (Drury); Nobgams; Omaruru R. (Haughton); Okambahe (Lebzelter).

GREAT NAMAQUALAND. Choarib; Choa's District (Hermann); Homeib R. near Klip (Siegmann).

KAOKOVELD. Kaoko Otavi (Barnard).

BRITISH BECHUANALAND. Banks of Epukiro-Omuramba, approx. 22° S., 10 km. east of Komeduve (Hermann).

Type in Stettin Museum.

## Achatina nyikaensis Pilsb.

1899. Achatina fragilis Smith, P.Z.S., p. 591, pl. xxxv, f. 3-4. D.F. Ancey, J. de C., l, p. 278. L.F. 1902.

Pilsb., Manual, xvii, p. 63, pl. ix, 1904. D.F.f. 25–26.

1909. Achatina nyikaensis (= fragilis Smith, 1899, non Desh. 1864) Pilsb., Manual, xx, p. 113. N.

1925. Achatina nyikaensis Pilsb., Conn., Trans. R. Soc. S. Africa, xii, p. 168. N.

Shell remarkable for its extreme thinness and fragility, the fringe of peristome usually membranaceous as in Natalina s.s. It is transparent, dull, rough to the touch, olive-yellow, either unicoloured with occasional darker stripes in the lines of growth, or with narrow vertical flames of pale red, which in some cases extend little beyond the periphery and in others are absent from the whole or part of the body whorl. Spire straight-sided, apex narrowly rounded. Whorls 7, moderately convex, with extremely strong criss-cross sculpture above the periphery, where it usually ceases, but the strong vertical striation continues to the base; suture simple; columella white, long and thin, basal truncation very narrow. A Macequece example measures

Alt. 75, lat. 38; apert. alt.  $45\frac{1}{2}$ , lat. 24; last whorl 60 mm., but the type from Nyika Plateau and the shell figured by Ancey belong to a broader race, 75 × 43 mm. in height and width.

Hab. S. RHODESIA. Mazoe Valley, Mashonaland (Arnold); Mt. Selinda, Melsetta (Miss A. de Klerk).

LORENZO MARQUES. Macequece District (Cressy).

Type in British Museum.

Easily recognised by its extreme fragility; specimens corresponding in their narrower form to the Macequece race have recently been collected by Pitman at Broken Hills, Northern Rhodesia. Bequaert suggests that this species would be better placed in Callistoplepa Ancey.

#### Achatina vassei Germ.

1918. Achatina vassei Germ., Bull. Mus. Paris, p. 368. D.F.

Shell elongate ovoid, rather thin and fragile, almost transparent, pale yellow with rather narrow red-brown flammules. Whorls 7½, embryonal small, remainder moderately convex, regularly increasing, the last more than half total length; embryonal smooth, remainder bearing above periphery oblique, fairly regularly transverse striae cut by fine spirals, closer on upper part of whorls against the sutures; below periphery only delicate, close, irregular transverse striation is present; suture well defined. Aperture elongate acuminate oval, columella narrow and twisted (after Germain).

Alt. 40.5, lat. 18.0; apert. alt. 20, lat. 8.5 mm.

Hab. LORENZO MARQUES. Andrada District (Vasse).

Type in Paris Museum.

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I have been unable to examine an example or obtain a photograph of this species; the original figure suggests deformation. Germain's description stresses the fact that on the early whorls the chestnut flammules are oblique, changing *suddenly* on the last to vertical, but this is a frequent feature in flammate Achatinae and of no specific or even varietal value.

# (vii) Group of panthera Fér.

Very large solid shells, uniform brown in colour, or with varying amount of brown mottling or strigation on a ground of buff or cream; all have very similar sculpture, consisting, after the first 2 or 3 whorls, of rather weak vertical striae, fairly strong on lower half of last whorl, and rather weak spirals on upper part of last 5 whorls, almost absent from lower half of the last; suture simple, shallow; columella usually very strongly truncate at base.

# (a) Columellar region pink.

# Achatina panthera (Fér.).

Ref. List No. 389.

1821. Helix (Cochlitoma) panthera Fér., Tabl. Moll., pt. 3, p. 53 (or 49). Nomen nudum.

1851. Achatina panthera Fér., Desh., Hist. Moll., ii, 2, p. 159, pl. exxvi, f. 1–2; pl. exxxii, f. 1–2. D.F.

1898. Achatina panthera Fér., Wiegm., Mitth. Zool. Samml. Mus. N.H. Berlin, i, p. 85, pl. iv, f. 5–6. A.R.

1917. Achatina panthera Fér., Standen, J. of C., xv, p. 160. Eggs. 1918. Achatina panthera Fér., Germ., Bull. Mus. Paris, p. 364. D.N.

1921. Achatina (Achatina) panthera Fér., Germ., Faune Mascareignes, p. 178, pl. x, f. 3-4; pl. xi, f. 2; pl. xiii, f. 5-6. D.F.

1925. Achatina panthera Fér., Conn., Trans. R. Soc. S. Africa, xii, p. 166. N.A.R.

Shell very large, acuminate ovate, typically buff or cream with irregular purplish blotches and broad streaks, usually shading into the ground colour on right, more strongly defined on left, when the species is clearly recognisable, but the pattern is subject to very great modification, tending towards a regular arrangement of vertical streaks of brown and cream, especially on the later whorls, when it is practically impossible to distinguish it from A. immaculata Lam., and only by its pink columellar region from some forms of fulica. The largest example in the British Museum is

Alt. 195, lat. 92; apert. alt. 92, lat. 48; last whorl 136 mm.; and Deshayes' figure of the type measures

Alt. 150, lat. 75; apert. alt. 76, lat. 42; last whorl 112 mm., but the average size of the species is considerably smaller.

Hab. unknown to Férussac.

TRANSVAAL. Queensriver, near Victoria Mines, Barberton District (Schenck) and Lebombo Mts., between Barberton and Delagoa; Kapaira (Beyrich, fide Martens).

S. RHODESIA. Sebakwe (Dodds); Umtali; Marandellas (Kidwell). LORENZO MARQUES. Tette (Peters; Kirk); Inhambane (Gibbons; Bowker); Rikatla (Junod); Andrada (Vasse); Amatongas (Arnold); Chinde (Miss L. Staunton); headwaters of R. Tristão, Macequece District (Cressy).

Widely distributed through East and Central Africa and some of the Mascarene Islands; two specimens in the South African Museum are labelled Port Elizabeth (Fairbridge), but if the locality is correct they were almost certainly introduced.

# var. minor Junod. Ref. List No. 389 (pars).

1899. Achatina panthera Fér., Smith, P.Z.S., p. 589, pl. xxxiv, f. 1. N.F.

1899. Achatina panthera Fér., var. minor Junod, Bull. Soc. Vaudoise, xxxv, p. 278. N.

1904. Achatina panthera Fér., Pilsb., Manual, xvii, p. 44, pl. xxxviii (1905), f. 30. N.F.

The form actually mentioned by Junod is referred to that figured on pl. cxxxii of Deshayes' Histoire, which measures alt. 108, lat. 57; apert. alt. 59, lat. 30; last whorl 85 mm., and his varietal name seems applicable to the beautiful race from Nyasaland figured by Smith, which shows the typical panthera colour pattern and most brilliant rosy peristome and columellar region, is extremely solid with unusually thick lip, and columellar truncation less pronounced than in the larger form. Its dimensions are very constant in such localities as those wherein I have noticed its occurrence, and I have no evidence of its ever having been collected in company with the larger form. An example from Mt. Selinda measures: alt. 95, lat. 44; apert. alt. 46·4, lat. 23·3; last whorl 70 mm.

Hab. LORENZO MARQUES. Rikatla (type, Junod); Macequece District (Cressy).

S. RHODESIA. Mt. Selinda (Miss A. de Klerk); Selinda Forest (Arnold).

Junod's type in Neuchatel Museum.

Also recorded from Nyasaland.

## Achatina immaculata Lam.

#### Ref. List No. 381.

1821. Helix (Cochlitoma) immaculata Lam., Fér., Tabl. Moll., pt. 3, p. 73 (or 69). Nomen nudum.

1822. Achatina immaculata Lam., Hist. Nat. An. s. Vert., vi, 2, p. 128. D.

1851. Achatina immaculata Lam., Desh., Hist. Moll., ii, 2, p. 158, pl. exxvii, f. 1–2. D.F.

1925. Achatina immaculata Lam., Conn., Trans. R. Soc. S. Africa, xii, p. 167. N.

Shell very large, acuminate ovate, solid, comparatively smooth, glossy, translucent, cream or buff background, more or less obscured, especially on last 2 whorls, by irregular, nearly vertical streaks of brown and chestnut, with scarcely a trace of mottling or maculation, interior milky blue, columella and callus pink. Spire produced, sides nearly straight, apex rather narrowly rounded. Whorls 7½, not very convex, regularly increasing, bearing rather coarse growth lines of irregular strength and, above the periphery, very close weak granulation of the usual pattern; suture simple. Aperture vertical, subpiriform, labrum straight and vertical in profile, columella erect, nearly straight, more or less strongly truncate near base of shell. The shell described, labelled "Natal," in British Museum measures

Alt. 129, lat. 66; apert. alt. 64, lat. 37; last whorl 98 mm.

Hab. unknown to Lamarck or Férussac.

TRANSVAAL. Barberton (Cregoe); Pietersburg District (Hewson); Messina (Gordon); Game Reserve (Miss Wilman); Pietpotgietersrust District (Money).

S. RHODESIA. Bulawayo; Zimbabwe (in coll. Crawford); Umvuma (Miss A. Smith); Shangani (Williams); Ndanga (Kirby); Salisbury (Phear).

LORENZO MARQUES. Delagoa Bay (Bequaert); Inhambane (Gibbons).

NATAL (Wahlberg); Tugela Valley (Quekett); Durban (in British Museum!).

ZULULAND. Mfongosi (fide Burnup); Hluhluwe Dist.; Manguzi R. near Kosi Bay (Bell Marley).

Type in Geneva Museum.

The headquarters of this difficult species seem to be in the Northern Transvaal, where it is very constant in shape but variable in colour; the apex is small and acute, and the whorls, about  $7\frac{1}{2}$  in number, increase regularly and somewhat rapidly, the last being nearly  $\frac{3}{4}$  of the entire length. Immature shells are sometimes almost white, with rare pale rufous streaks; mature examples all shades from pale buff to dull chestnut, sometimes with darker streaks and blotches;

columella, paries, and peristome bright rose-red or pink, often showing round the outside of the peristome; it is often, however, a very difficult matter to determine shells of this species and panthera from districts where they intermingle, or appear to do so. A Zulu animal is dark grey, head, tentacles and stripe down centre of neck dark red-brown, with a paler stripe of reddish buff running back from the face along each side of neck.

#### (b) Columellar region whitish.

Achatina fulica (Fér.). Ref. List No. 377.

1821. Helix (Cochlitoma) fulica Fér., Tabl. Moll., pt. 3, p. 53 (or 49). L.

1851. Achatina fulica Fér., Desh., Hist. Moll., ii, 2, p. 162, pl. exxiv A, f. 1; pl. exxv, f. 3–5. D.F.

1901. Achatina rediviva Mab., Bull. Soc. Philom., Paris, iii, p. 57. D.

1914. Achatina fulica Fér., Gude, Faun. India, Moll., ii, p. 340. D.N.

1916. Achatina fulica Fér., Conn., Ann. S.A. Mus., xiii, p. 188. N. 1921. ,, ,, (=rediviva Mab.), Germ., Faune Mascareignes, p. 183, pl. x, f. 1-2; pl. xi, f. 1; pl. xii, f. 1-2. D.F.

1934. Achatina fulica Fér., Jutting, J. of C., xx, p. 43. N.

As the sole record of this species from South Africa rests on a single immature example believed to have been imported from Mauritius into Durban among plants, it seems superfluous to repeat the fairly full synonymy given in my Reference List, although that may be found by no means complete when further research is made into the relations of the over-many East African species, differentiated on account of size alone or trifling details unworthy of even varietal separation.

The typical sculpture and colour pattern is very similar to that of panthera, and is subject to much the same variation, while the shell varies considerably in size and contour, but, in so far as I understand the species, the columellar region is invariably whitish, the only conchological feature that serves to distinguish between panthera and itself when intermediates in form and other details occur. The shell figured by Deshayes on pl. cxxv is much striped and varicoloured above, and almost unicoloured below the periphery; it contains 7 whorls and measures

Alt. 75, lat. 39.5; apert alt. 41, lat. 21; last whorl 55 mm.

An adult example from Dar-es-Salaam in my collection with just over 7 whorls measures: alt. 96, lat. 46; apert. alt. 50, lat. 24; last whorl 71 mm., and another from Tanga, with 7 whorls, is alt. 102, lat. 55; apert. alt. 59, lat. 29; last whorl 78 mm., the columella in this case, as might be expected from the obese contour, being far more concave than usual in this species.

Hab. NATAL. Durban (Burnup).

Type ubi?

Rather widely distributed along the east coast of tropical Africa, whence it has gradually spread into the Middle East and becomes a scourge to planters in India, Ceylon, and now in Malaya and the Dutch East Indies, a remarkable fact when we remember that in their natural home on the east coast these creatures do no harm whatever, save it be to give possible indigestion to the indigenes who regard them as a culinary delicacy.

## Achatina glutinosa Pfr. Ref. List No. 378.

1852. Achatina glutinosa Pfr., P.Z.S., p. 86. D.

1859. ,, petersi Mts., Mal. Blätt., vi, p. 214. D.

1904. ,, *glutinosa* Pfr., Pilsb., Manual, xvii, p. 61, pl. ix, f. 23, 24. *D.F.* 

1918. Achatina (Achatina) glutinosa Pfr., Germ., Bull. Mus. Paris, p. 366. D.

1925. Achatina glutinosa Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 168. N.

Another large species, but typically less solid than the preceding three, of more uniform chestnut colour, sometimes with paler streaks, and whitish columellar region. After the first 2 or 3 whorls the entire surface is covered with very close and regular, nearly vertical transverse striae, cut by spiral grooves of the same strength and character, most of which, however, are weaker or missing, while others develop almost into spiral furrows on the last whorl, which Pfeiffer aptly describes as smoothish, with a gummy gloss. The type, with  $7\frac{1}{2}$  whorls, measures Alt. 98, lat. 47; apert. alt. 54, lat. 28-5; last whorl 75 mm.

Hab. LORENZO MARQUES. Tette (petersi); Sena (Peters); Andrada (Vasse); Macequece District; Mtisherra R. Valley (Cressy); Amatongas Forest (Arnold).

S. RHODESIA. Near Victoria Falls (Babault).

Type of glutinosa in British, petersi in Berlin Museum.

Glutinosa was described as from West Africa, but the locality is doubtless erroneous.

## (viii) Group of tracheia Conn. Achatina tracheia Conn.

(Pl. xi, f. 8.)

1929. Achatina tracheia Conn., Ann. Natal Mus., vi, p. 233, pl. xiv, f. 26. D.F.

1930. Achatina tracheia Conn., Ann. S.A. Mus., xxix, p. 295. N.L.

Shell comparatively small, acuminate ovate, thin, rugose, pale cream, with irregular chestnut streaks, which become much closer on the later whorls and almost coalesce near the aperture. Spire moderately produced, apex narrowly rounded. Whorls 7, moderately convex, the remarkably strong, nearly vertical sculpture consisting, on the 2nd whorl, of rows of transverse puckers, divided into spiral lines and increasing in length on each succeeding whorl, the raised portions white and interstices chestnut. Aperture subovate, columella roseate. The type measures

Alt. 54.9, lat. 28.9; apert. alt. 30.3, lat. 16.3; last whorl 42.8 mm., but the shell varies in breadth from about 31.5 to 28.0 mm.

Hab. KAOKOVELD. Kaoko Otavi (type); Hoarusib River (Barnard).

Type in South African Museum.

Easily distinguishable by its close, narrow strigation and strong transverse striation, which renders it rough to the touch, in which respect it resembles some individuals of nyikaensis, without pertaining to the same group.

#### Subfamily Subulininae.

Shells ranging from medium to minute, generally slender or turrited, but sometimes ovate, without internal lamellae; buff, brown or olivaceous, rarely with darker streaks.

> Genus Pseudoglessula O. Bttg., 1892 (Nachr.-Bl. D. Mal. Ges., xxiv, p. 202). Type Achatina calabarica Pfr.

Shell acuminate ovate to turriform, typically imperforate, regularly costulate on all whorls, apex rounded, columella usually truncate; foot with lateral grooves and caudal pore; lateral teeth without inner, rarely without outer cusps, marginals bicuspid, the mesocones sometimes very long.

Sub-genus Kempioconcha Preston, 1913 (Rev. Zool. Afr., iii, p. 212).

Type Kempia kivuensis Prest.

(= Kempia Prest., 1913, non Matthews, 1912, and Pseudocerastus Germ., 1918).

Columella normally without truncation, blending evenly into the basal margin of the shell.

## Pseudoglessula kirki (Dhrn.).

1865. Buliminus kirki Dhrn., P.Z.S., p. 232. D.

1868. Bulimus kirki Dhrn., Pfr., Mon. Hel., vi, p. 54. D.

1880. ,, kirkii Dhrn., Crvn., P.Z.S., p. 217. L.

1881. ,, (*Buliminus*) *kirki* Dhrn., Smith, P.Z.S., p. 282, pl. xxxii, f. 9. *N.F.* 

1889. Bulimus bridouxi Bgt., Moll. Afr. Équat., p. 53, pl. ii, f. 4-5. D.F.

1891. Buliminus kirki Dhrn., Mts., Sitz.-Ber. Ges. Nat. Fr., p. 16. L.

1897. Buliminus kirki Dhrn., Mts., D.-O.-A., iv, p. 62. N.

1901. Buliminus (Rhachis) kirkii Dhrn., Kob., Conch. Cab., p. 722, pl. evi, f. 19. D.F.

1901. ,, (Rhachis) bridouxi Bgt., Kob., Conch. Cab., p. 813, pl. exviii, f. 23. D.F.

1925. Pseudoglessula (Pseudocerastus) kirki Dhrn. (= bridouxi Bgt.), Conn., Trans. R. Soc. S. Africa, xii, p. 170. N.

Shell rather large, turriform, umbilicate, silky, rather dull, pale corneous reddish brown. Lower part of spire rather broad, sides practically straight, apex mamillate. Whorls 7, not very convex, regularly increasing, sculptured to extreme apex with strong, close, regular, straight, very slightly oblique costae, which are at least twice as far apart on the first 2 as on the later whorls; suture simple, a little impressed. Aperture suboval, labrum receding a little in a slight curve, columella erect, nearly straight, margin broadly reflexed over the narrow umbilicus. A fine Mtisherra example measures

Long. 26·0, lat. 11·5; apert. alt. 10·7, lat. 5·4; last whorl 16·2 mm.

Animal ovoviviparous, young shells acutely angled at periphery until the last whorl.

Hab. LORENZO MARQUES. Amatongas Forest (Arnold); Mtisherra R. Valley (Cressy).

S. RHODESIA. Selinda Forest (Arnold).

Type of kirki in British, paratype of bridouxi in Paris Museum. Kirki was described from Mozambique and is also recorded from Tanganyika Territory, and bridouxi was described from the province last mentioned.

I pointed out in 1925 that specimens from Mtisherra R., which were pronounced by Germain identical with *bridouxi*, were also identical with the type of *kirki*; it is a rather more obese form than the next species, with a tendency to expansion of the peristome, a feature that I have not observed in *boivini*.

## Pseudoglessula boivini (Morel.). (Text-fig. 27.)

Ref. List No. 303.

1860. Glandina boivini Morel., Séries Conch., ii, p. 72, pl. v, f. 5. D.F.

1890. Bulimus (Cerastus) mamboiensis Smith, A.M.N.H., vi, p. 153, pl. v, f. 7. D.F.

1898. *Buliminus movenensis* Stur., S.A. Moll., p. 66, pl. ii, f. 44-51. *D.F.* 

1914. Buliminus (Ena) boivini Morel., Dautz. & Germ., Rev. Zool. Afr., iv, p. 20. L.

1916. Buliminus (Ena) boivini Morel., Germ., Bull. Mus. Paris, xxii, p. 252. D.

1918. Buliminus (Pseudocerastus) boivini Morel., Germ., Bull. Mus. Paris, xxiv, pp. 261, 362. L.N.

1925. Pseudoglessula (Pseudocerastus) boivini Morel., Conn., Trans. R. Soc. S. Africa, xii, p. 171, pl. vi, f. 1-4. D.F.A.R.

1936. Pseudoglessula (Kempioconcha) zulu Haas, Abh. Senckenb. Ges., No. 431, p. 14, pl. i, f. 9. D.F.

Smaller and narrower than the foregoing, which it resembles closely in other respects, except that the apical costae are scarcely wider apart than those on the later whorls. Sides straight or very slightly convex, nearly 7 fairly convex whorls, columellar reflexion and umbilicus narrower than in *kirki*. A typical Macequece example measures

Long. 20.5, lat. 9.1; apert. alt. 8.0, lat. 4.0; last whorl 12.4 mm.

Hab. ZULULAND. Elscheleselwanhla (Toppin); Kosi Bay (Burnup); Umfolosi Game Reserve (type) and Mkuzi (zulu, Haas).

LORENZO MARQUES. Delagoa Bay (Connolly); Movene (movenensis, Penther); Rikatla; under stones in the Lebombo Mts. (Junod); Andrada (Vasse); Maxixe (Lawrence); district north of Macequece (Cressy); Wanetsi R., Majude District (Bell Marley).

Types of boivini and mamboiensis in British, movenensis in Vienna, zulu in Senckenberg Museum; it is probable that Ps. subolivaceus

Smith (=olivaceus Taylor) is also identical with this species, as is Limicolaria borellii "Ancey," Mts., if correctly represented in the Dautzenberg collection.

Haas was unaware that *boivini* occurred in Zululand; comparison with a paratype of *zulu* which he has kindly shewn me leaves no doubt as to the synonymy.

The radula formula is about  $(25+1+25) \times 73-76$ , central narrow, with single short cusp, 5 laterals broad and almost unicuspid, marginals

Text-fig. 27.—Pseudoglessula boivini (Morel.), Kosi Bay. Teeth from radula;  $\times 300$ .

with small, but distinct outer cusp. Eggs nearly globular, about 2.7 mm. across, young shells much less angulate at periphery than in kirki; the shell varies a little in diameter, the broader specimens having slightly more convex sides than the narrower.

Originally described from Mombasa, this is the commonest species of the genus, being known from Zanzibar, Kenya Colony, Nyasaland, Tanganyika Territory and the Belgian Congo.

## Pseudoglessula gibbonsi (Taylor).

1877. Buliminus gibbonsi Taylor, Q.J.C., i, p. 280, pl. iii, f. 1. D.F.

1899. Buliminus boivini Morel., var., Smith, P.Z.S., p. 587. N. 1900. ,, (Pachnodes) gibbonsi Taylor, Kob., Conch. Cab., p. 642, pl. xevii, f. 16-17. D.F.

1925. Pseudoglessula (Pseudocerastus) gibbonsi Taylor, Conn., Trans. R. Soc. S. Africa, xii, p. 178. D.

The shells which I attribute, with much diffidence, to this species are far shorter and comparatively more obese than *boivini*, which they resemble in sculpture. The sides are straight, apex submamillate, 7 convex whorls, columella concave, margin broadly reflexed, umbilicus narrow. A full-grown Mtisherra example measures

Long. 14.9, lat. 7.9; apert. alt. 6.3, lat. 3.7; last whorl 9.5 mm.

Young shells well angulate at periphery until the last whorl. Hab. LORENZO MARQUES. Mtisherra R. Valley (Cressy). Type ubi?

Described from Mozambique.

The Mtisherra shells are identical with some from Nyasaland which Smith considered might be a variety of boivini, than which, however, they are smaller, with shorter whorls, and the peripheral angulation when immature does not appear to occur in typical qibbonsi, which also has slightly less convex whorls, but without further material it may be best to refer them to that species.

## Pseudoglessula cressyi Conn.

1925. Pseudoglessula (Pseudocerastus) cressyi Conn., Trans. R. Soc. S. Africa, xii, p. 174, pl. iv, f. 28; pl. vii, f. 1-7. D.F.A.R.

A rather large, turriform shell, subrimate in type, but frequently imperforate, differing from all the foregoing in this feature instead of being clearly umbilicate. Sides straight, apex mamillate. Whorls 8, not very convex, slightly bluntly angulate at periphery, except on last whorl of fully mature examples, first 2 strongly and rather distantly transversely costate, with traces of very fine microspiral lines between the ribs, remainder covered with close, regular, straight, slightly oblique transverse costulae, weaker and nearly three times closer than those on the first 2 whorls; suture well defined. Aperture subovate, labrum nearly straight and receding slightly in profile, columella nearly white, concave or straight, either with narrowly reflexed margin, forming a minute rima, or slightly truncate at the base, without marginal reflexion. The type measures

Long. 22.0, lat. 8.7; apert. alt. 7.7, lat. 4.8; last whorl 12.1 mm., the largest specimen seen being  $26.3 \times 9.75$  mm.

Hab. LORENZO MARQUES. District north of Macequece (type, Cressy).

S. RHODESIA. Vumba Mountains, Umtali (Arnold).

Type in British Museum.

Radula measures  $3 \times 1.2$  mm., central tooth narrow, with short cusp, laterals and marginals bicuspid, without endocones, formula  $(27+1+27)\times 100$  in one specimen and  $\times 77$  in another. The features of the columellar region might suggest that this species is wrongly placed in Kempioconcha, but its anatomical characters leave little doubt as to its affinity with boivini. It is important to note that in both species the penial retractor arises from the columella muscle and not from the diaphragm, as Pilsbry states that it does in Ps. stuhlmanni (Mts.).

> Genus Homorus Albers, 1850 (Die Helic., p. 196). Type Achatina cyanostoma Pfr.

Shell subulate, smooth, buff or brown, apex rounded, columella truncate, eggs oblong. Only one species is yet known from South Africa, namely,

#### Homorus manueli Prest.

1910. Homorus manueli Prest., Proc. Mal. Soc., ix, p. 54. D.F. 1925. ,, ,, ,, Conn., Trans. R. Soc. S. Africa, xii, p. 179. N.

Shell rather large, elongate turriform, imperforate, smooth, glossy, bright brown. Sides straight, apex mamillate. Whorls 12, rather flat, slowly increasing, first 2½ smooth, remainder practically so except for somewhat distant, more or less strong, short, subsutural wrinkles, which only rarely extend across the whorl as very faint, nearly vertical striolae; suture subcrenulate, well defined. Aperture short, acuminate ovate, labrum nearly straight and receding somewhat in profile, columella white and glossy, concave, narrowly rectangularly truncate just above base of shell.

Long. 24.7, lat. 5.3; apert. alt. 4.2, lat. 2.6; last whorl 8.2 mm.

Hab. LORENZO MARQUES. Mtisherra R. Valley; Zangwe Basin (Cressy); Maforga Siding, B. & M. Rly. (McDowell).

Type in Tervueren Museum.

Described as from 200 miles east of Loanda, Angola; the type is not quite mature, only  $19 \times 4.5$  mm.

# Genus Subulina Beck, 1837 (Index Moll., p. 76).

Type Bulimus octonus Brug.

Shell turriform, imperforate, thin, smooth or weakly striate, apex smooth, rounded, peristome simple, columella basally truncate without marginal reflexion. Central tooth of radula narrow, laterals nearly symmetrical, with inner and outer cusps, marginals also tricuspid; eggs round.

## Subulina octona (Brug.).

#### Ref. List No. 425.

1786. Helix octona Indiae Occidentalis, Chem., Conch. Cab., ix, 2, p. 190, pl. cxxxvi, f. 1264. D.F.

1792. Bulimus octonus Brug., Encycl. Méth. Vers, i, p. 325. D.

1898. Subulina octona Chem., Wiegm., Mitth. Zool. Samml. Mus. Naturk. Berlin, i, p. 91. A.R.

1914. Subulina octona Brug., Gude, Faun. India, Moll., ii, p. 341. D.

1916. ,, ,, Conn., Ann. S.A. Mus., xiii, p. 189. N.

1920. ,, Chem., Germ., Voy. Babault, p. 119. *L*.

1931. ,, Brug., Peile, Proc. Mal. Soc., xix, p. 269. R.

Shell of fair size, smooth and glossy, sides straight, tapering extremely gradually, apex broadly rounded. Whorls 8, convex, very slowly increasing, first 1½ smooth, remainder with extremely faint, close, regular, nearly vertical striolae, hardly

perceptible but for infrasutural puckers, suture well defined. Aperture short oval, labrum straight and nearly vertical in profile, columella short, concave, obliquely truncate at base. My largest Rhodesian example measures

Long. 14.8, lat. 3.8; apert. alt. 3.25, lat. 1.75; last whorl 5.5 mm.

Hab. S. RHODESIA. Rain Forest, Victoria Falls (Dixey & Longstaff).

CAPE PROVINCE. "Grottes de Cango, near Oudshorn" (Babault, fide Germain).

Type ubi?

An American species, introduced by commerce over much of the globe, and easily recognisable by its smooth shell, with broad apex and short, nearly equal whorls; it has a near relation in Africa in S. entebbana Pollonera, which resembles it in form but is clearly, finely and sharply striate; Preston has distributed the Rhodesian race under a manuscript name, dedicated to Miss Leppan.

A new record of its eastward distribution is that of the Solomon Islands, whence the British Museum received it in 1934 from R. J. Lever.

## Subulina mamillata (Crvn.). Ref. List No. 424.

1880. Achatina mamillata Crvn., P.Z.S., p. 215, pl. xxii, f. 8. D.F. 1906. Subulina mamillata Crvn., Pilsb., Manual, xviii, p. 73 in synonymy.

1926. Subulina mamillata Crvn., K. & W., Syn. Brit. Moll., p. 358 in synonymy.

1930. Subulina mamillata Crvn., Conn., Proc. Mal. Soc., xix, p. 40. N.

Shell of fair size, smooth and glossy, sides of spire straight or contracting slightly above the 4th whorl, apex narrowly rounded. Whorls 10, fairly convex, gradually increasing, first  $2\frac{1}{2}$  smooth, remainder nearly so, the faint growth striolation being hardly visible under a strong lens; suture noticeably oblique. Aperture acuminate ovate, labrum receding somewhat to base, columella short, erect, sharply truncate at base. My largest Rhodesian example measures

Long. 20.6, lat. 4.4; apert. alt. 4.7, lat. 2.4; last whorl 8.5 mm.

Hab. S. RHODESIA. Victoria Falls (Dixey & Longstaff).

Described by Craven as from Nossi Bé, and also recorded by him from Magila, while Pitman has recently collected it at Shamaponda, N. Rhodesia. Pilsbry has placed this species in the synonymy of octona, and Kennard and Woodward followed his example, but mamillata is very distinct by its finer apex, flatter and more rapidly increasing whorls and consequently more oblique suture, and fine, though faint, transverse sculpture.

#### Subulina turtoni Conn.

1923. Subulina turtoni Conn., A.M.N.H., xi, p. 358, pl. i, f. 24. D.F.

Shell of moderate size, smooth and glossy, sides straight, apex submamillate. Whorls (in type) 8, convex, regularly increasing, first 2 smooth, later with extremely faint, close, vertical striolae; suture simple. Aperture subrhombic, labrum straight and nearly vertical, columella concave, obliquely truncate at base.

Long. 11.8, lat. 3.1; apert. alt. 2.8, lat 1.6; last whorl 4.8 mm.

Hab. S. RHODESIA. Khami (type, Turton); Bulawayo (in S.A. Museum); Lusanyama District (Quekett).

TRANSVAAL. Zoutpansberg and Messina (in S.A. Museum).

Type in British Museum.

The largest shell examined, with 9 whorls, measures  $15 \cdot 2 \times 3 \cdot 9$  mm.

A somewhat featureless shell, smaller than the two foregoing, and larger than the two following species, all that are yet known south of the River Zambesi.

## Subulina gracillima Conn.

1919. Subulina gracillima Conn., Rec. Albany Mus., iii, p. 216. D.F.

Shell small, smooth and glossy, sides straight, apex narrowly rounded. Whorls 9, moderately convex, gradually increasing, earlier smooth, remainder covered with close, nearly straight and vertical striae, very weak in the type race, but stronger in that from Gatooma, particularly in puckers just below the sutures; suture well defined. Aperture short ovate, labrum straight and receding little in profile, columella short, concave, rather sharply truncate.

Long. 12.0, lat. 2.5; apert. alt. 2.1, lat. 1.2; last whorl 4.8 mm.

Hab. S. RHODESIA. Victoria Falls (type, Connolly); Gatooma (Rump).

Type in British Museum.

#### Subulina vitrea (Mouss.).

#### Ref. List No. 426.

1887. Stenogyra (Subulina) vitrea Mouss., J. de C., xxxv, p. 296, pl. xii, f. 6. D.F.

1892. Stenogyra chapmani M. & P., A.M.N.H., ix, p. 90, pl. vi, f. 3. D.F.

1922. Subulina vitrea Mouss., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., pp. 38, 39, f. 14, a. D.N.F.

1930. Subulina vitrea Mouss., Conn., Ann. S.A. Mus., xxix, p. 296. N.

Shell small, smooth and glossy, sides straight, apex narrowly mamillate. Whorls 11, convex, gradually increasing, first 3 smooth, remainder bearing extremely weak, irregular, nearly vertical growth lines; suture well defined. Aper-

ture acuminate ovate, labrum straight and receding but little in profile, columella concave, sharply truncate at base.

Long. 11.7, lat. 2.4; apert. alt. 2.3, lat. 1.1; last whorl 4.1 mm.

Hab. OVAMBOLAND (chapmani, Chapman); Ku-Ganab, S.E. of Ondonga (vitrea, Schinz).

KAOKOVELD. Near Otjitundua; Hoarusib R. (Barnard).

DAMARALAND. Otavi Mountain (Frames); Tsumeb; Otjikoto Lake; Brakwater, 20 km. north of Windhoek; Okahandja (Michaelsen); Onguati (Thomsen); Outjo; Namutoni; Sandup; Cauas Okawa (Barnard).

GREAT NAMAQUALAND. Gaub and Diab River District (Edlinger).

Type of chapmani in British, vitrea in Zurich Museum.

Genus Subuliniscus Pilsb., 1919 (Bull. Amer. Mus. N.H., xl, p. 145). Type Subulina ruwenzoriensis Pollon.

Summit of shell acutely conoid, not rounded, embryonic whorls spirally engraved, columella basally truncate.

Subuliniscus chiradzuluensis (Smith). (Text-fig. 28.)

1899. Subulina chiradzuluensis Smith, P.Z.S., p. 588, pl. xxxiii, f. 46. D.F.

1906. Subulina chiradzuluensis Smith, Pilsb., Manual, xviii, p. 93, pl. xiv, f. 47. D.F.

1925. Subuliniscus chiradzuluensis Smith, Conn., Trans. R. Soc. S. Africa, xii, p. 179, pl. v, f. 9-16. N.A.R.

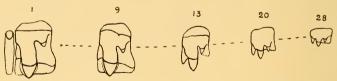
Shell of good size, elongate turriform, imperforate, smooth and glossy. Sides very slightly convex, summit acute. Whorls 9, rather flat, 1st minute, remainder regularly increasing, first 2 sculptured with extremely fine, faint, and close microspiral lines, only apparent in freshest condition, remainder with close, faint, very slightly curved and oblique growth striolae; suture well defined. Aperture short, acuminate oval, labrum nearly straight and erect in profile, columella concave, strongly rectangularly truncate shortly above the basal margin. A well-grown Macequece example measures

Long. 19·3, lat. 5·5; apert. alt. 5·2, lat. 2·3; last whorl 8·8 mm. The first 4 whorls of immature shells are sharply angulate.

Hab. LORENZO MARQUES. District north of Macequece (Cressy).

S. RHODESIA. Vumba Mountains, Umtali (Arnold). Type in British Museum.

Described from Nyasaland, the type set being noticeably less obese than that described above,  $19\cdot2\times5\cdot1$  mm., but the volution and sculpture appear identical and no varietal separation necessary. The animal is ovoviviparous and the anatomy differs in several



Text-fig. 28.—Subuliniscus chiradzuluensis (Smith), Macequece.

Teeth from radula; × 600.

respects from that of Subulina, being possibly more nearly related to Bocageia.

Radula  $2 \times 0.85$  mm., central tooth extremely narrow with single vestigial cusp, laterals and marginals tricuspid, decreasing greatly in size towards the edges, formula  $(32+1+32)\times 102$ ; it differs from those of *Subulina octona* and allied forms chiefly in the very inconspicuous endocones of the lateral teeth.

Genus *Euonyma* M. & P., 1896 (A.M.N.H., xviii, p. 316, and Pilsb., Manual, xviii, 1906, p. 38).

Type Subulina laeocochlis M. & P.

Based on the sinistral laeocochlis M. & P., and extended by Pilsbry to include a group of species, mostly South African, which differ from Opeas in larger size and from Homorus and Subulina in the columella blending evenly into the basal margin instead of being basally truncate. This grouping is not really tenable, however, since laeocochlis has an acute apex, like Subuliniscus, and may possibly prove to be congeneric therewith, so that the remaining forms, all of which have apices more or less rounded, cannot rightly be included in Euonyma. It would nevertheless be unwise to create new genera for them, or to assign them arbitrarily to other existing genera, without full knowledge of their comparative anatomy, so in order to avoid complicating the matter further it may be advisable to leave them for the present in M. & P.'s genus.

The shell is medium to large in size, elongate turriform, thin, more or less transparent, pale olivaceous, peristome simple, columella not basally truncate.

The genus, as temporarily accepted, is divisible into three main

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groups, depending on the form of the apex, whether acute, narrowly or broadly rounded.

(i) Apex acute.

Euonyma laeocochlis (M. & P.). Ref. List No. 438.

1896. Subulina laeocochlis M. & P., A.M.N.H., xviii, p. 316, pl. xvi, f. 3. D.F.

Shell large, sinistral, elongate turriform, rimate, thin, silky, probably pale olivaceous. Spire produced, narrowing slightly from 6th whorl upwards, apex acute. Whorls 12, nearly flat, regularly increasing, bluntly angulate until nearing maturity, first 2 weathered, with no visible sculpture, remainder sculptured all over with strong, close, regular, straight, nearly vertical costulae; suture very oblique. Aperture narrow, subquadrate, peristome simple, labrum broken, columella straight and erect, margin narrowly reflexed, almost obliterating the very narrow rima.

Long. 30.4, lat. 8.8; apert. alt. ca 8.0, lat. ca 4.8; last whorl 11.8 mm.

Hab. CAPE PROVINCE. Humansdorp, St. Francis Bay (Fraser). Type in British Museum.

The straightness of the transverse sculpture and probably also of the labrum provides a further point of difference between this species and group (ii), while its acute apex separates it widely from group (iii).

- (ii) Shell lanceolate, apex very narrowly rounded, eggs round, usually small and many, most species ovoviviparous.
  - (a) Large shells, exceeding 35 mm. in length.

Euonyma lanceolata (Pfr.).

Ref. List Nos. 439, 442.

1854. Bulimus lanceolatus Pfr., P.Z.S., p. 292. D.

1857. ,, micans Pfr., Mal. Blätt., iv, p. 156. D.

1905. Obeliscus natalensis Bnp., Proc. Mal. Soc., vi, p. 304, pl. xvi, f. 9. D.F.

1923. Euonyma lanceolata Pfr. ( = natalensis Bnp.), Conn., A.M.N.H., xi, p. 356.  $\,$   $\,$   $\,$   $\,$   $\,$   $\,$   $\,$   $\,$   $\,$ 

1925. Euonyma lanceolata Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 183. L.

Shell large, turriform, rimate, with silky sheen, pale yellowish olivaceous. Sides straight, apex narrowly rounded. Whorls 12½, nearly flat, gradually increasing, 1st smooth, 2nd weakly and remainder strongly sculptured with close, rather coarse, regular, slightly curved, nearly vertical lirae; suture shallow. Aperture VOL. XXXIII.

acuminate ovate, labrum slightly arcuate and receding in profile, columella straight, erect, margin very narrowly reflexed, nearly obliterating the narrow rima. The type measures

Long. 52·0, lat. 15·0; apert. alt. 14·0. lat. 6·5; last whorl 21·7 mm.

Hab. NATAL. Cape Natal (Plant); rather widely distributed from Pietermaritzburg to the south coast.

LORENZO MARQUES. Near Delagoa Bay (in British Museum). All types in British Museum.

I pointed out in 1923 that much confusion had arisen regarding this species owing to the strength of sculpture varying somewhat according to its state of preservation, being on the whole more prominent in fresh than rubbed or weathered specimens, a fact which caused the name lanceolata to be misapplied to the smoother form dealt with hereunder, although its sculpture in reality agrees with that of micans and natalensis.

The eggs are very small and numerous.

## Euonyma lymneaeformis (M. & P.).

Ref. List No. 441.

1901. Obeliscus lymneaeformis M. & P., A.M.N.H., viii, p. 317, pl. ii, f. 5. D.F.

1923. Euonyma lymneaeformis M. & P., Conn., A.M.N.H., xi, p. 356, pl. i, f. 4. N.F.

This species was founded on abnormal shells, while its normal form was universally distributed under the name of lanceolata, and the true lanceolata as natalensis; the shell is smoother and narrower than the foregoing, my largest specimen contains  $11\frac{1}{2}$  flat whorls, sculptured as lanceolata except that the strong coarse lirae are replaced by weak striae.

Long.  $37\cdot2$ , lat.  $9\cdot8$ ; apert. alt.  $10\cdot5$ , lat.  $4\cdot6$ ; last whorl  $15\cdot6$  mm.; a specimen of lanceolata  $30\cdot5$  mm. long is  $9\cdot5$  mm. in breadth.

The eggs are very small and numerous.

Hab. NATAL. Karkloof Bush (type, McBean); distribution much the same as for the last species.

Type in British Museum.

(b) Shells of medium size, about 14-30 mm. in length.

#### Euonyma terebraeformis Conn.

1923. Euonyma terebraeformis Conn., A.M.N.H., xii, p. 634, pl. xix, f. 37. D.F.

Shell of fair size, rimate, silky, pale olivaceous. Sides straight, apex rounded. Whorls 11, not very convex, first  $2\frac{1}{2}$  smooth, remainder sculptured all over with extremely fine and close, faint, regular, curved, very slightly oblique transverse

striae, which are cut by equally close microspiral lines; suture well defined. Aperture suboval, labrum slightly arcuate forward and receding a little farther to the base, columella erect, slightly concave, margin narrowly reflexed, nearly concealing the small rima. The type measures

Long. 23.5, lat. 6.0; apert. alt. 6.3, lat. 2.5; last whorl 9.8 mm., but Falcon's

largest specimen, also with 11 whorls, is

Long. 29.8, lat. 7.1; apert. alt. 7.3, lat. 3.3; last whorl 15.6 mm.

Hab. CAPE PROVINCE. Port St. Johns (type, Warren).

NATAL. Umtamvuna R. mouth (Falcon).

Type in British Museum.

A well-defined species, resembling in miniature the last two, rather than any of the *acus* group, than all of which it has longer whorls.

## Euonyma turriformis (Krs.). (Text-fig. 29a.)

1848. Bulimus turriformis Krs., Südafr. Moll., p. 78, pl. v, f. 2. D.F.

1906. Euonyma turriformis sarissa Pilsb., Manual, xviii, p. 44, pl. x, f. 84–85. D.F.

Shell of fair size, elongate turriform, hardly subrimate, thin, smooth, glossy, pale yellowish olivaceous. Spire produced, sides nearly straight, narrowing almost imperceptibly from the 5th whorl upwards, apex narrowly rounded. Whorls 9, little convex, regularly increasing, first 2 smooth, remainder covered with close, weak, curved vertical striolae; suture simple, shallow. Aperture subovate, labrum curved slightly forward and vertical in profile, columella long, straight, erect, margin narrowly, almost adnately reflexed.

Long. 17.0, lat. 5.1; apert. alt. 5.8, lat. 2.25; last whorl 8.9 mm.

Hab. NATAL (turriformis, Wahlberg; sarissa, Cassin); Pine Town (Burnup); Drummond (Rump).

Type of turriformis in Stuttgart Museum, sarissa in Academy of Natural Sciences, Philadelphia.

A comparatively rare form, which, as explained under the following species, occurs in company with acus in Krauss' original lot, the latter having been erroneously accepted as typical of his species. There can be no doubt, however, as to his original type, since the shell described above is the only individual which agrees with his measurements thereof. The species attains somewhat larger dimensions, and varies a little in obesity and outline of spire in series from the same locality, my two largest Pinetown examples measuring  $21 \cdot 6 \times 5 \cdot 7$  and  $21 \cdot 0 \times 5 \cdot 1$  mm. in height and width. It resembles terebraeformis in having longer whorls than those which follow, and Pilsbry has kindly informed me that he agrees that, in view of the particulars here set forth, sarissa should fall into synonymy.

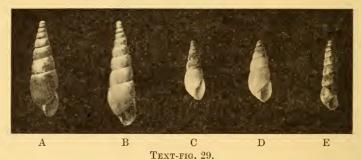
Euonyma acus (Morel.). (Text-fig. 29B.)

Ref. List No. 449 (as turriformis).

1889. Stenogyra acus Morel., J. de C., xxxvii, p. 8, pl. i, f. 6. D.F. 1896. Subulina glaucocyanea M. & P., A.M.N.H., xviii, p. 317, pl. xvi, f. 5. D.F.

1910. Euonyma turriformis Krs., var. acus Morel. (=glaucocyanea M. & P.), Conn., A.M.N.H., vi, p. 257, pl. vi, f. 2. D.N.F.

When compiling my "Survey of South African Stenogyrinae" in 1910, the Kraussian types in the Stuttgart Museum were not available to me, so I based my deductions on specimens from the Krauss



A. Euonyma turriformis (Krs.). Type in Stuttgart Museum.
B. ,, acus (Morel.), Port Elizabeth.
C. ,, tugelensis (M. & P.). Type in British Museum.
D. ,, durbanensis (Stur.), Durban.
E. Opeas lineare (Krs.). Type in Stuttgart Museum.

All figures twice natural size.

and Wahlberg collections most kindly lent me by Dr. Théel of the Stockholm Museum, and the reputed paratype of turriformis was an example of the very common form which has usually passed under that name. However, the type set in the Stuttgart Museum contains three shells, of which one agrees with the common form, but the others, of which the largest is obviously Krauss' type, are entirely distinct and are identical with sarissa Pilsbry.

Fortunately there is no necessity to manufacture a new name for the common form, as acus Morelet is available; the type is an overgrown giant with 13 whorls, measuring: long. 26.7, lat. 6.0; apert. alt. 5.5, lat. 2.5; last whorl 9.5 mm., but as these exceptional dimensions scarcely ever occur, I describe below a specimen of average size.

Shell of fair size, rimate, smooth, rather dull, olivaceous. Sides straight, apex narrowly rounded. Whorls 10, not very convex, gradually increasing, first 2

smooth, remainder sculptured with very close, regular, fine, faint, slightly curved vertical striolae and traces of negligible microspiral lineation; suture well defined. Aperture suboval, labrum gently arcuate, columella straight and erect, margin narrowly reflexed, half covering the narrow rima.

Long. 18.0, lat. 4.8; apert. alt. 5.2, lat. 2.5; last whorl 8.1 mm.

Hab. Widely distributed throughout the south from Bredasdorp District, Grahamstown etc. in the Cape Province to Natal and Zululand. Types of acus (Crawford) and glaucocyanea (Fraser), both from Port Elizabeth, in British Museum.

The shell varies somewhat in contour and distance between sutures in different local races, but not sufficiently so to justify even varietal separation on purely conchological grounds; it is the common species of the south, being replaced further north by varia and unicornis Conn. S. glaucocyanea is merely one of a set with slight tinge of blue on the epidermis, a frequent feature in this species. The eggs are extremely small.

## Euonyma pruizenensis Conn.

Ref. List No. 445.

1910. Euonyma pruizenensis Conn., A.M.N.H., vi, p. 261, pl. vi, f. 11. D.F.

Shell of fair size, elongate turriform, very narrowly rimate, somewhat silky. Sides straight or tapering slightly nearing the mamillate apex. Whorls  $8\frac{1}{2}$ , 1st smooth, 2nd microscopically, remainder clearly sculptured with regular, rather coarse, curved vertical striae; suture impressed. Aperture ovate, labrum arcuate forward in profile, columella erect, margin narrowly reflexed, almost adnate in full-grown shells, so as nearly to obliterate the rima.

Long. 20.2, lat. 5.1; apert. alt. 5.3, lat. 2.5; last whorl 8.7 mm.

Hab. TRANSVAAL. Pruizen (type); bushveldt near Pietpot-gietersrust (Connolly).

Type in British Museum.

The presence of transverse sculpture on all but the extreme apex is a noteworthy feature, that on the 2nd whorl being almost visible without a lens.

## Euonyma varia Conn.

Ref. List No. 451.

1910. Euonyma varia Conn., A.M.N.H., vi, p. 263, pl. vi, f. 5-7. D.F.

Shell of fair size, narrow elongate turriform, rimate, with silky sheen. Sides normally straight, apex narrowly rounded. Whorls 10½, slightly convex, first 2 smooth, remainder sculptured with very close, fine, faint, regular, curved, nearly vertical striae; suture somewhat impressed. Aperture subovate, labrum rather

sharply arched forward to about  $1\frac{1}{2}$  mm. below suture, receding considerably thence to base, columella nearly straight, margin narrowly triangularly reflexed. Long. 17·0, lat. 4·1; apert. alt. 4·2, lat. 1·8; last whorl 6·6 mm.

Hab. TRANSVAAL. Pienaars Poort (type); Pretoria District (Connolly); Potchefstroom (Miss Cachet); Zoutpansberg (Cregoe). Type in British Museum.

The northern form of *acus*, with which it was formerly confused; the whorls, however, increase less rapidly, and the last whorl and aperture are consequently slightly shorter than in *acus*; the epidermis, too, is of less silky sheen and more stramineous colour. Extremes differ considerably in contour, the type being intermediate in form; the species is ovoviviparous, with a quantity of minute round eggs.

## Euonyma unicornis Conn. Ref. List No. 450.

1910. Euonyma unicornis Conn., A.M.N.H., vi, p. 265, pl. vi, f. 3. D.F.

Very similar to the last species, from which it differs constantly in having one more whorl and slightly shorter aperture in comparison to its size, and in its rather more convex whorls; the shell is rimate, rather glossy, with straight sides and narrowly rounded apex; whorls  $11\frac{1}{2}$ , convex, very slowly increasing, suture rather deep. Aperture short, nearly elliptical, columella slightly concave, other details as in varia.

Long. 21.0, lat. 4.4; apert. alt. 4.2, lat. 2.5; last whorl 7.0 mm.

Hab. TRANSVAAL. Schanz Kop, Pretoria (type, Connolly); Potchefstroom (Miss Livingston).

CAPE PROVINCE. Cradock (var., Farquhar); Molteno (var., Hewitt).

ORANGE FREE STATE. Bloemfontein (var., Connolly).

Type in British Museum.

The animal is canary yellow, upper tentacles 2 mm. long, with black eyes, lower very short; body 8 mm. when extended, neck 4 mm., tail long, tapering and pointed, back streaked with longitudinal rows of minute tubercles. The ovary usually contains 8 or 9 eggs, which show clearly in a single line through the last 2 whorls of the shell.

The western forms have slightly blunter apex and coarser striation than the type, but without anatomical examination it appears inadvisable to separate them.

In the four following species the apex is almost imperceptibly coarser than in the foregoing members of this group.

## Euonyma standeri Conn.

Ref. List No. 448.

1910. Euonyma standeri Conn., A.M.N.H., vi, p. 264, pl. vi, f. 9. D.F.

Shell rather small, elongate turriform, rimate, with silky sheen; sides straight, apex rounded, blunt for the size of shell, being 1 mm. in diameter. Whorls  $7\frac{1}{2}$ , moderately convex, first 2 smooth, remainder sculptured with close, slightly curved, nearly vertical striae of rather irregular depth; suture well defined. Aperture subovate, comparatively large, labrum hardly curved forward, but a little retracted towards the base, columella straight, margin triangularly reflexed.

Long. 14.0, lat. 4.5; apert. alt. 4.5, lat. 1.9; last whorl 6.7 mm.

Hab. TRANSVAAL. Standers Kop (Connolly).

Type in British Museum.

Distinguishable from acus by its dull silky epidermis, longer apical whorls, and blunter apex; in contour it closely resembles the next species, which has a more shining, imperforate shell.

#### Euonyma siliqua Conn.

Ref. List No. 447.

1910. Euonyma siliqua Conn., A.M.N.H., vi, p. 262, pl. vi, f. 10. D.F.

Shell rather small, somewhat subulate, imperforate, with slightly silky sheen. Sides straight, apex bluntly rounded, nearly 1 mm. across. Whorls 8, convex, first 2 smooth, remainder sculptured with very fine, curved transverse striae of rather irregular prominence and extremely faint microspiral lineation, only discernible under very strong magnification: suture rather deeply impressed. Aperture subovate, labrum slightly arcuate in profile, columella erect, thickened and twisted upwards, with no trace of reflexion. The type measures

Long. 13.8, lat. 4.3; apert. alt. 3.5, lat. 1.7; last whorl 6.5 mm.

Hab. NATAL. O.R.C. Junction Station (Connolly).

Type in British Museum.

A rather short, thick species with very blunt apex, differing from most others of its size in lack of perforation; it is particularly subject to dimorphism, three other paratypes measuring respectively  $13.8 \times 4.0$ ,  $12.4 \times 4.2$ , and  $10.3 \times 3.5$  mm., the smallest shell containing eggs. The shell bears very close resemblance to that of the next species, but appears to be of duller texture.

Euonyma durbanensis (Stur.).

(Text-fig. 29D.)

Ref. List No. 428.

1898. Opeas durbanense Stur., S.A. Moll., p. 61, pl. ii, f. 42-44. D.F.

Very similar to the last, but with smoother, glossier surface and, in most examples, a most minute rima. Sides of spire practically straight, apex narrowly rounded, 8 whorls, not very convex, with hardly a trace of sculpture, suture somewhat impressed. Labrum very slightly curved and receding but little in profile, columella straight, erect, margin narrowly adnately reflexed, so that the minute rima, when present, is only discernible under a lens.

Long. 13.0, lat. 4.1; apert. alt. 4.2, lat. 2.0; last whorl 6.8 mm.

Hab. NATAL. Durban (type, Penther; Puzey); Otto's View (Falcon); Verulam (Cawston).

Type in Vienna Museum.

Founded on a single immature specimen with only 6 whorls, 9.2 mm. in length, this species had not been rediscovered in the original locality until three years ago, when it was collected by Puzey in sufficient variety to prove that the type, for the opportunity of examining which I am indebted to Dr. Adensamer of the Vienna Museum, can attain the above dimensions when fully grown and should be placed in the same little sub-group as standeri, siliqua, and tugelensis, from the last of which it differs in very slightly slower increase in length of whorl and its sides being a trifle less straight. It has, in fact, been confounded with tugelensis to such an extent that I only quote localities recently verified, but it may probably prove to be more widely distributed than that species.

Euonyma tugelensis (M. & P.). (Text-fig. 29c.) Ref. List No. 434.

1897. Subulina tugelensis M. & P., A.M.N.H., xix, p. 637, pl. xvii, f. 9. D.F.

Smaller than the three preceding, narrowly subulate and rimate, smooth and glossy. Sides regular, apex rounded. Whorls 7, not very convex, regularly increasing, first 2 practically smooth, remainder sculptured with very weak, fairly close and regular, curved vertical growth lines and extremely fine and close microspiral striolae; suture well defined. Aperture suboval, labrum evenly curved forward and vertical in profile, columella erect, rather long, lower margin extremely narrowly and closely reflexed, almost concealing the narrow rima.

Long. 11.1, lat. 3.7; apert. alt. 4.25, lat. 1.75; last whorl 6.0 mm.

Hab. NATAL. Lower Tugela River (type); Pietermaritzburg (Burnup); Illovo R. (Taynton).

LORENZO MARQUES. Delagoa Bay (Connolly).

Type in British Museum.

The shell varies somewhat in width, the Maritzburg race averaging  $12 \times 3.5$  mm.; the eggs are large and few.

(iii) Shell subulate, apex broad, eggs usually large and round, animal ovoviviparous. Distribution as yet known confined to the Cape Province.

## Euonyma platyacme M. & P. Ref. List No. 444.

1907. Euonyma platyacme M. & P., A.M.N.H., xix, p. 101, pl. vi, f. 15. D.F.

1907. Stenogyra beckeri Fulton, ibid., p. 154, pl. x, f. 7. D.F.

Shell large, elongate subulate, imperforate, smooth and glossy, pale corneous yellow. Sides straight, apex domed. Whorls 11, nearly flat, gradually increasing, first 2 bearing fine microspiral lines, which then fade away, transverse striolation negligible; suture shallow. Aperture short, acuminate oval, labrum straight, receding considerably to base, columella erect, margin scarcely thickened, unreflexed.

Long. 40.5, lat. 9.4; apert. alt. 9.0, lat. 4.9; last whorl 14.6 mm.

Ovoviviparous, eggs large, globular; some of the young attain a length of 3 mm. before leaving the parent shell.

Hab. CAPE PROVINCE. Kei Road Bush (platyacme, Miss Hickey); Pondoland (beckeri, Becker); Hog's Back Mountain, Queenstown (Farguhar); Pirie Forest (Godfrey); Amabile Junction (Puzey).

Both types in British Museum.

Very distinct by its large size, blunt apex, and smooth, glossy shell.

## Euonyma cacuminata (M. & P.). Ref. List No. 435.

1892. Stenogyra cacuminata M. & P., A.M.N.H., ix, p. 85, pl. vi, f. 2. D.F.

Shell of fair size, imperforate, smooth, glossy, pale olivaceous; sides straight, apex rounded. Whorls 10, nearly flat, sculptured with extremely faint, close, straight, nearly vertical striolae; suture shallow. Aperture short, acuminate ovate, labrum straight, receding but little, columella erect, concave, almost imperceptibly angulate at base, margin unreflexed. The shell described measures

Long. 19.0, lat. 4.9; apert. alt. 4.0, lat. 2.2; last whorl 7.2 mm., but the largest Katberg specimen, with 11 whorls, is  $23.6 \times 5.3$ , apert.  $5.0 \times 2.9$ , last whorl 8.3 mm.

Hab. CAPE PROVINCE. Bedford (type, Farquhar); Boschberg Mountains, Somerset East (Mrs. Howard); Katherg Forest (Hewitt). Type in British Museum.

Much smaller than the preceding species, which it resembles in its smooth, glossy shell and flattened whorls.

#### Euonyma barnardi Conn.

1929. Euonyma barnardi Conn., Ann. Natal Mus., vi, p. 234, pl. xiv, f. 27. D.F.

Shell of fair size, most narrowly rimate, stramineous. Sides tapering very gradually, apex rounded. Whorls 7, flattish, regularly increasing, sculptured with very faint, close, regular, vertical striae; suture shallow. Aperture acuminate ovate, labrum gently recurved, columella slightly concave and inclined to the right, margin very narrowly, almost adnately reflexed, nearly obliterating the minute rima.

Long. 20.0, lat. 5.5; apert. alt. 5.4, lat. 2.9; last whorl 9.8 mm.

Hab. CAPE PROVINCE. Swellendam Mountains (type); Groot Vaters Bosch, Heidelberg; Lemoens Hoek Mts., Langeberge (Barnard). Type in South African Museum.

The blunt apex and comparatively rapid increase of whorling distinguish this species amply from other members of its group.

#### Euonyma decipiens Conn.

1929. Euonyma decipiens Conn., Ann. Natal Mus., vi, p. 235, pl. xiv, f. 28. D.F.

Shell large, imperforate, stramineous olivaceous. Sides regular, apex rounded. Whorls 10, flattish, gradually increasing, subangulate at periphery except on last whorl of completely mature examples, covered from apex to base with extremely fine, close, microspiral striolation, and weak, rather distant, irregular growth wrinkles after the 2nd whorl; suture well defined. Aperture subovate, labrum recurved, columella narrowly truncate near base.

Long. 39.5, lat. 9.8; apert. alt. 8.3, lat. 5.2; last whorl 15.0 mm.

Hab. CAPE PROVINCE. Riversdale Mountains, 1500-2500 ft. (type); Groot Vaters Bosch, Heidelberg (Barnard).

Type in South African Museum.

The imperforate shell and truncate columella suggest that this species should be placed in the tropical genus *Homorus*, but its close resemblance to *platyacme* and round eggs seem to justify its present position; in addition to truncate columella, the whorls are more convex than in M. & P.'s species.

## Euonyma purcelli (M. & P.).

Ref. List No. 446.

1901. Subulina purcelli M. & P., A.M.N.H., viii, p. 317, pl. ii, f. 6. D.F.

Shell of fair size, imperforate, smooth, glossy, corneous buff. In many specimens the right side of spire tends to narrowing about the 6th whorl, imparting to it a slightly crooked aspect, though the left side is straight; apex domed. Whorls

10½, not very convex, sculptured all over with extremely fine microspiral lineation, and on later whorls very faint, close, straight, nearly vertical striolae, stronger immediately below the suture. Aperture short, acuminate ovate, labrum straight, receding somewhat to base, columella white, erect, usually slightly angulate, hardly truncate, at its base, without marginal reflexion. The type is immature, the specimen here described measuring

Long. 23.4, lat. 5.3; apert. alt. 4.3, lat. 2.5; last whorl 8.6 mm.

The eggs are large and globular, over 2 mm. in diameter.

Hab. CAPE PROVINCE. Houw Hoek, Caledon Division (type, Purcell); 4 miles south of Bredasdorp; Lemoens Hoek Mountains, Langebergen, Heidelberg Division; Palmiet River Mountains, 2000 ft. (Barnard); Mossel River Mountains, Hermanus (Rennie).

Type in British Museum.

The whorls are much shorter than in *decipiens*, which it resembles to some extent in form and texture; the specimens from Palmiet River Mountains show particularly strong microspiral sculpture, the largest, with  $10\frac{1}{2}$  whorls, measures  $25 \times 5$  mm.

## Euonyma gouldi Conn. Ref. List No. 437.

1912. Euonyma gouldi Conn., Ann. S.A. Mus., xi, p. 214, pl. ii, f. 7. D.F.

Shell of fair size, elongate turriform, subrimate, slightly glossy. Sides slightly convex, apex bluntly rounded. Whorls 10, gradually increasing in size but decreasing in convexity, first 2 smooth, remainder sculptured with close, faint, almost straight, slightly oblique striae; suture well defined. Aperture short, ovate, labrum nearly straight and receding slightly in profile, columella concave, margin very narrowly reflexed, forming a small rima.

Long. 19.5, lat. 5.1; apert. alt. 4.3, lat. 2.2; last whorl 7.1 mm.

Hab. CAPE PROVINCE. Prieska (type, Gould; van der Merve). GRIQUALAND WEST. Koegas (R. Olds).

Type in South African Museum.

Nearest to cacuminata, with duller surface and more convex whorls.

Genus Opeas Albers, 1850 (Die Helic., p. 175).

Type Stenogyra goodalli Miller.

Shell medium to very small, otherwise as in *Euonyma*; apex smooth, columella not truncate, eggs round, usually small and very numerous.

It is difficult to fix the line of demarcation between the larger forms of this genus and the smaller of *Euonyma*, but in the arrangement here adopted I have placed in *Opeas* a number of species with small

apex and narrow contour, which it is fairly easy to separate from those just treated, and which are divisible into two groups purely according to their average size.

(i) Shell usually exceeding 7 mm. in length.

Opeas lineare (Krs.). (Text-fig. 29E.) Ref. List Nos. 440, 443.

1848. Bulimus linearis Krs., Südafr. Moll., p. 78, pl. v, f. 3. D.F. 1909. Subulina pietersburgensis Prest., A.M.N.H., iv, p. 499. D.F.

Shell rather small, elongate turriform, narrowly rimate, thin, somewhat silky, olivaceous. Spire produced, sides practically straight, apex narrowly rounded. Whorls 9, somewhat convex, gradually increasing, all but the first 2 covered with close, fine, regular, arcuate vertical costulae; suture well defined. Aperture acuminate ovate, labrum arcuate forward and then receding to base, columella erect, nearly straight, margin narrowly reflexed over the small rima. The type measures

Long. 13.0, lat. 3.1; apert. alt. 2.4, lat. 1.6; last whorl 4.9 mm.

Hab. BRITISH BECHUANALAND. Mt. Mohapaani (lineare, Wahlberg); Francistown (Mrs. Landhorn).

TRANSVAAL. Pietersburg (pietersburgense fide Preston); Pietpotgietersrust (Connolly); Zoutpansberg (in South African Museum).

S. RHODESIA. Khami (Turton); Matopos Terminus (Farquhar); Tati (in South African Museum); Bulawayo; Hope Fountain; Sawmills (Arnold); Ngamandhlovu (Stevenson); Holly's Hope (Cockshott).

Type of lineare in Stuttgart, pietersburgense in British Museum.

When I penned my survey in 1910 the exact location of Mt. Mohapaani was uncertain and there were only a single paratype of lineare and the type of pietersburgense available for examination, the former being shorter by 2 whorls than the latter, hardly sufficient evidence on which to formulate a definite opinion as to their relationship. Since then, however, not only has Gyldenstolpe (Ark. f. Zool., 1926) proved that Wahlberg's mountain is actually situate S.W. of Palapye Road Station, but the species has come to hand from a chain of localities extending across the northern districts of Bechuanaland and the Transvaal and the south of Rhodesia, and furnishing abundant proof of the synonymy presented above. The type of Preston's species is the largest specimen yet known to me, possessing 10 whorls and measuring  $14.3 \times 3.0$  mm., but the sculpture and other details are in complete accord with average examples of lineare.

#### var. levis Conn.

#### Ref. List No. 443.

1910. Euonyma pietersburgensis Prest., var. levis Conn., A.M.N.H., vi, p. 255, pl. vi, f. 8. D.F.

Smoother and more polished than the typical form, but running into it through large series; the type contains  $9\frac{1}{2}$  whorls, the very fine striation being scarcely visible without a lens. It measures

Long. 12.4, lat. 3.0; apert. alt. 3.1, lat. 1.3; last whorl 4.9 mm.

Hab. TRANSVAAL. Buis Kop (type); Pienaars Poort (Connolly); Zoutpansberg (Cregoe); Messina (in South African Museum).

Type in British Museum.

#### Opeas sublineare O. Bttg.

#### Ref. List No. 433.

1910. Opeas sublinearis Bttg., Abh. Senckenb. Ges., xxxii, p. 448, pl. xxviii, f. 14. D.F.

1930. Opeas sublineare Bttg., Conn., Ann. S.A. Mus., xxix, p. 296. N.

Smaller, smoother and glossier than the last species, imperforate, with less arcuate striation. 11 moderately convex whorls, first 2 smooth, remainder sculptured with very close, fine, regular, curved, nearly vertical striolae. Aperture very short, acuminate ovate, labrum little curved and receding slightly in profile, columella slightly concave, without marginal reflexion. The largest specimen to hand, from Fish R. Mountains, measures

Long. 13.5, lat. 2.5; apert. alt. 2.3, lat. 1.2; last whorl 4.5 mm.

Hab. LITTLE NAMAQUALAND. Muishond (type, Schultze); Henkries (Lightfoot).

GRIQUALAND WEST. Modder River (Miss Wilman); Newlands (Miss Paton).

GREAT NAMAQUALAND. Bremen Farm, S.W. of Warmbad (Haughton); Klein Karas and Fish River Mountains (Miss Hill).

Type in Senckenberg Museum.

## Opeas crystallinum (M. & P.).

#### Ref. List No. 436.

1896. Subulina crystallina M. & P., A.M.N.H., xviii, p. 316, pl. xvi, f. 4. D.F.

1925. Euonyma crystallina M. & P., Conn., Trans. R. Soc. S. Africa, xii, p. 183. N.

Shell usually rather small, but type of fair size, narrowly rimate, smooth and glossy. Sides straight, apex narrowly rounded. Whorls 11, not very convex, gradually increasing, first  $2\frac{1}{2}$  smooth, remainder sculptured with very fine, faint, close, regular, curved, nearly vertical striolae; suture well defined. Aperture subpiriform, labrum gently arcuate in profile, columella inclined slightly inwards, margin most narrowly reflexed, almost obliterating the minute rima. The type measures

Long. 15.0, lat. 2.8; apert. alt. 2.8, lat. 1.5; last whorl 5.4 mm.

Hab. NATAL. Pietermaritzburg (type, Burnup); widely distributed.

CAPE PROVINCE. Widely distributed in the Eastern Province. ZULULAND. Mfongosi (Jones); Eshowe (Lady Saunders); Nonoti (Burnup).

LORENZO MARQUES. Lebombo Marsh, Rikatla (Junod); Masiene (Lawrence).

Type in British Museum.

The type is unusually well developed, the generality of specimens containing about 9 whorls with dimensions of  $10.8 \times 2.6$  mm.; the usual Zulu form is distinctly narrower, an Eshowe example with 9 whorls measuring  $10 \times 2.3$ , last whorl 3.8 mm. The shell is far more glossy than others of its size, and easily distinguishable from Hypolysia florentiae M. & P. by the latter's margined suture.

## Opeas eulimoide (Prest.).

Ref. List No. 429.

1909. Subulina eulimoides Prest., A.M.N.H., iv, p. 499. D.F.

Shell small, acicular, imperforate, smooth and glossy. Sides straight, apex narrowly rounded. Whorls 8, nearly flat, first 2 smooth, remainder sculptured with very fine and faint, close, regular, curved, vertical striolae; suture well defined. Aperture narrow acuminate ovate, labrum gently arcuate in profile, columella erect, concave, margin slightly thickened upwards but practically unreflexed.

Long. 9.7, lat. 2.2; apert. alt. 2.2, lat. 1.2; last whorl 4.7 mm.

Hab. NATAL. Howick (type, Cregoe).

TRANSVAAL. Piet Retief (Crawshay).

Type in British Museum.

Smaller than the smallest form of crystallinum, to which it bears close general resemblance; the type is not quite mature, with half a whorl less and shorter in proportion than the Transvaal example described, which contains two fair-sized eggs. The shell differs from Micropeas in shape of aperture.

## Opeas mcbeani M. & P.

Ref. List No. 431.

1903. Opeas mebeani M. & P., A.M.N.H., xii, p. 604, pl. xxxi, f. 8. D.F.

Shell small, acicular, subrimate, slightly silky. Sides straight, apex narrowly rounded. Whorls 10, moderately convex, first  $2\frac{1}{2}$  smooth, remainder bearing very fine, close, regular, curved, nearly vertical striae; suture rather deep. Aperture suboval, labrum gently recurved to base, columella straight, margin so narrowly reflexed that there is practically no rimation. The type measures

Long. 9.7, lat. 2.1; apert. alt. 1.8, lat. 1.2; last whorl 3.8 mm.

Hab. TRANSVAAL. Boksburg (type, McBean); Pretoria; Hennops River (Connolly); Middelburg (Crawford).

Type in British Museum.

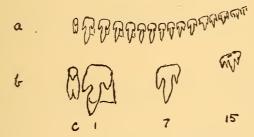
Resembles *sublineare* in form and *lineare* in sculpture, but is far smaller than either; the usual number of eggs is two, the species commencing to breed when half grown.

## Opeas praecox Conn.

(Text-fig. 30.)

1925. *Opeas praecox* Conn., Trans. R. Soc. S. Africa, xii, p. 183, pl. iv, f. 25. *D.F.R.* 

1928. Opeas praecox Conn., Peile, Proc. Mal. Soc., xviii, p. 268. R.



Text-fig. 30.—Opeas praecox Conn., Zangwe Basin.

A. Half row of teeth from radula of immature, but fertile specimen;  $\,\times\,300$  approximately.

B. Individual teeth enlarged.

Shell of fair size, elongate turriform, narrowly rimate, smooth and glossy. Sides straight, apex narrowly rounded. Whorls 8, rather flat, regularly increasing, first 2 smooth, remainder sculptured with rather faint, close, fairly regular, curved vertical striae; suture shallow. Aperture subpiriform, labrum projecting rather sharply forward for about  $1\frac{1}{4}$  mm., at which point it is slightly sinuate, and then receding more gently to base, columella very slightly concave, margin very narrowly reflexed, nearly concealing the narrow rima.

Long. 11.3, lat. 3.0; apert. alt. 3.0, lat. 1.2; last whorl 5.0 mm.

Hab. LORENZO MARQUES. Zangwe River Basin (type, Cressy). Also known from Nyasaland.

Type in British Museum.

Varies considerably in contour and slightly in length of whorl, but all intermediate stages exist; a figure of the radula is appended.

#### Opeas albaniense Conn.

1919. Opeas albaniense Conn., Rec. Albaný Mus., iii, p. 217. D.F.

Shell small, elongate turriform, rimate, smooth and glossy. Sides straight, apex narrowly rounded. Whorls  $7\frac{1}{2}$ , but little convex, first 2 smooth, remainder bearing close, faint, curved striolae; suture shallow. Aperture piriform, labrum somewhat arched forward and receding a little further to the base, columella short, margin very narrowly reflexed over the minute rima.

Long. 9.2, lat. 3.1; apert. alt. 3.0, lat. 1.3; last whorl 4.5 mm.

Hab. CAPE PROVINCE. Alicedale (type, Cruden); Grahamstown (Farquhar); East London (Rattray).

Type in Albany Museum, Grahamstown.

Somewhat smaller than praecox or lineare, with slightly more convex whorls, and a little larger throughout than lepidum, the apex being slightly broader and each whorl slightly longer.

## Opeas cressyi Conn.

1922. Opeas cressyi Conn., A.M.N.H., x, p. 120. D. 1925. ,, ,, ,, Trans. R. Soc. S. Africa, xii, p. 185, pl. iv, f. 27. N.F.

Shell small, elongate fusiform, imperforate, smooth and glossy. Sides regular, apex narrowly rounded. Whorls 7, rather convex, rather rapidly increasing, first 2 smooth, remainder sculptured with close, regular, curved, vertical striae, visible to the naked eye; suture somewhat oblique, well defined. Aperture elongate acuminate ovate, labrum well arched forward below the suture, receding more gradually to base, columella weak, concave, almost imperceptibly truncate. The type measures

Long. 10.8, lat. 2.8; apert. alt. 3.3, lat. 1.2; last whorl 5.7 mm.

Hab. LORENZO MARQUES. District north of Macequece (Cressy).

Type in British Museum.

The shell shows extreme variation in contour, egg-holding and therefore nearly mature specimens ranging down to a length of only 5 mm., while individuals appear to differ in relative convexity of whorl, distance between sutures and closeness and depth of striation. There

seem, however, to be such exact intermediates between each extreme that I can only conclude that they are all members of one species and that the variation is due partly to local conditions and partly, perhaps, to individual reversion to earlier and more distinct types, of whose interbreeding the present confused race is the result. The following short table sets forth dimensions of a few extreme forms, intermediates being omitted:

Long. 9.2, lat. 2.8; apert. alt. 3.1; last whorl 5.2 mm.

	,		- /	T	,		-	200 220
,,	9.2	,,	$2 \cdot 3$	,,	3.1	,,	$5 \cdot 0$	,,
,,	8.3	,,	$2 \cdot 2$	,,		,,	4.8	;;
,,	8.0	,,	$2 \cdot 7$	,,	$3 \cdot 2$	,,	4.9	,,
,,	6.9	,,	1.95	,,	$2 \cdot 3$	,,	4.0	
,,	6.4	,,	$2 \cdot 15$	,,	2.55	,,	4.3	,,

The sculpture is rather stronger and whorls flatter and increasing more rapidly than in other members of this group.

(ii) Shell narrow, very small, seldom exceeding 7 mm. in length.

Opeas lepidum Conn.

Ref. List No. 430.

1910. Opeas lepidum Conn., A.M.N.H., vi, p. 267, pl. vi, f. 12. D.F.

Shell small, elongate turriform, subrimate, smooth, rather glossy. Sides straight apex rounded. Whorls 6, rather convex, regularly increasing, 1st smooth, 2nd nearly so, remainder sculptured with extremely faint, regular, curved striae; suture well defined. Aperture short oblong oval, labrum gently arched forward, columella very slightly concave, margin narrowly reflexed, almost concealing the minute rima.

Long. 7.0, lat. 2.5; apert. alt. 2.3, lat. 1.2; last whorl 3.7 mm.

Hab. CAPE PROVINCE. Fern Kloof, Grahamstown (type, Farguhar); Port Elizabeth (Crawford).

Type in British Museum.

The largest of the group, representing albaniense in miniature, but never much exceeding the above dimensions.

Opeas crawfordi (M. & P.).

Ref. List No. 427.

1893. Stenogyra crawfordi M. & P., A.M.N.H., xii, p. 105, pl. iii, f. 4. D.F.

Shell very small, acicular, subrimate, smooth and glossy. Sides straight, apex narrowly rounded. Whorls 6, not very convex, regularly increasing, first 2 smooth, remainder bearing very fine, faint, curved, vertical striolae; suture well defined. VOL. XXXIII.

Aperture quadrate, rounded at base, labrum vertical and gently arcuate in profile, columella nearly straight, erect, margin most narrowly reflexed, rima microscopic. My largest topotype measures

Long. 5.5, lat. 1.9; apert. alt. 1.9, lat. 0.75; last whorl 3.1 mm.

Hab. CAPE PROVINCE. Van Staaden's River, Port Elizabeth (type, Crawford); Racecourse, Grahamstown (var., Farquhar); frequent in Grahamstown District; Kowie East (Kincaid); Port Alfred (Hewitt).

Type in British Museum.

Considerably smaller than the foregoing, which it resembles in most other respects. I am in doubt as to the exact status of the Grahamstown race, but hardly consider it to be separable; the largest specimen, with 7 whorls, measures  $7.5 \times 2.2$ , last whorl 3.7 mm.

## Opeas strigile (M. & P.).

Ref. List No. 432.

1901. Subulina strigilis M. & P., A.M.N.H., viii, p. 318, pl. ii, f. 7. D.F.

1919. Opeas strigile M. & P., Conn., Proc. Mal. Soc., xiii, pp. 142, 143. D.F.

Shell small, elongate turriform, narrowly rimate, smooth and glossy. Sides very slightly convex, apex narrowly rounded. Whorls 6, moderately convex, gradually increasing, 1st smooth, remainder covered with fairly close, curved, vertical striae of rather irregular depth; suture subfiliform, well defined. Aperture subovate, labrum erect and arcuate in profile, columella nearly straight, margin triangularly reflexed, nearly obscuring the rima.

Long. 5·3, lat. 1·7; apert. alt. 2·0, lat. 0·8; last whorl 2·9 mm.

Hab. NATAL. Karkloof (type, McBean); Karkloof and Fort Nottingham (Burnup); Bulwer (Warren) and Gordon Falls (Falcon, fide Burnup).

Type lost; paratype, described above, in Natal Museum.

About the same size as *crawfordi*, but with rather shorter whorls and crisper striolation.

## Opeas fanei Conn.

1919. Opeas fanei Conn., Proc. Mal. Soc., xiii, p. 143. D.F.

Shell small, acuminate, rimate, smooth and glossy. Sides straight, apex narrowly rounded. Whorls 8, nearly flat, gradually increasing, first 2 smooth, remainder covered with close, faint, regular, curved vertical striolae; suture becoming subfiliform about the 5th whorl. Aperture small, subovate, labrum erect and arcuate in profile, columella straight, margin narrowly reflexed.

Long. 7.5, lat. 1.7; apert. alt. 2.0, lat. 0.6; last whorl 3.3 mm.

Hab. NATAL. Pietermaritzburg (type); Dargle (Burnup). Type in British Museum.

Smoother and more attenuate than *strigile*, with flatter whorls; the type is about a millimetre longer than the generality of specimens. The Dargle shells differ slightly in contour from the type set, but are not varietally separable.

#### Opeas vengoense Conn.

1922. Opeas vengoense Conn., A.M.N.H., x, p. 120. D. 1925. ,, ,, Trans. R. Soc. S. Africa, xii, p. 185, pl. iv, f. 26. N.F.

Shell very small, elongate fusiform, imperforate, smooth and glossy. Sides regular, apex narrowly rounded. Whorls  $5\frac{1}{2}$ , flattish, regularly increasing, 1st smooth, 2nd nearly so, remainder sculptured with fine, regular, somewhat oblique, curved transverse striae, which are only visible under a lens; suture well defined. Aperture elongate acuminate ovate, labrum slightly curved forward, columella weak, concave, adnately thickened without truncation or marginal reflexion.

Long. 6·3, lat. 1·7; apert. alt. 1·8, lat. 0·7; last whorl 3·6 mm.

Hab. LORENZO MARQUES. Mount Vengo, 5500 feet (Cressy). CAPE PROVINCE. Majuba Nek, Herschel District (var., Hepburn).

Type in British Museum.

With rather stronger sculpture and longer, flatter whorls than any of the foregoing members of its group, the shell is in reality a miniature of O. cressyi, from the young of which it can be distinguished by its smaller form and comparatively longer last whorl. The Herschel race shows rather stronger and broader columellar reflexion, but does not appear varietally separable.

Section Micropeas Conn., 1923 (A.M.N.H., xii, p. 655). Type Opeas péringueyi Conn.

Very small imperforate shells, with rather slowly increasing whorls and no columellar truncation; the whorls are much shorter than in *Cecilioides*, which is similar in texture. The distribution extends to Kenya and Camerun.

## Opeas péringueyi Conn.

1923. Opeas (Micropeas) péringueyi Conn., A.M.N.H., xii, p. 656, pl. xix, f. 24. D.F.

Shell very small, aciculate, imperforate, smooth and glossy. Spire produced, summit, 3 whorls, sub-bulbous, apex narrowly rounded. Whorls 7, moderately

convex, regularly and gradually increasing, first 3 smooth, with faintest symptoms of close microspiral lines, remainder covered with very faint, close, curved vertical striolae, only visible under the microscope; suture very narrowly margined, well defined. Aperture subpiriform, peristome simple, labrum curved a little forward, receding further to base, columella slightly concave, without marginal reflexion, merging evenly into the basal lip without truncation.

Long. 6.6, lat. 1.9; apert. alt. 1.7, lat. 0.75; last whorl 3.3 mm.; a larger,

damaged example is 7.1 mm. in length.

Hab. ZULULAND. Mfongosi (Jones). Type in South African Museum.

Sub-species lathon Conn.

1923. Opeas (Micropeas) péringueyi, sub-sp. lathon Conn., A.M.N.H., xii, p. 656, pl. xix, f. 25. D.F.

Similar to above, but a little smaller in all its parts, comprising  $6\frac{1}{2}$  whorls and measuring

Long. 5·3, lat. 1·4; apert. alt. 1·5, lat. 0·6; last whorl 2·7 mm.

Hab. NATAL. Port Natal (type, J. Sanderson, 1861). LORENZO MARQUES. Mt. Vengo (Cressy).

Type in British Museum.

As proof of the ignorance that prevailed until recently regarding South African Stenogyrinae, it is interesting to note that this minute, slender form reposed on a tablet for over sixty years in the British Museum stigmatised as "Stenogyra turriformis Krs. (juv.)," the wiseacre who determined it being apparently under the impression that the apical whorls of a turriform shell increased in obesity together with its normal increase in length.

Genus Pseudopeas Putz., 1899
(Ann. Soc. R. Mal. Belg., xxxiv; Bull. Sè., p. lviii).

Type Ps. pulchellum Putz.
(= Beccaria Bgt., 1883, non Trinchese, 1870).

Small shells differing from *Opeas* in having spiral sculpture on the apical whorls; eggs spherical. Rather an artificial genus, the three South African species possibly belonging to three distinct genera; Putzeys stated originally that the apical whorls were smooth, but later examination revealed their microspiral sculpture.

#### Pseudopeas victoriae Conn.

1919. Pseudopeas victoriae Conn., Rec. Albany Mus., iii, pp. 217, 218. F.D.

Shell small, subrimate, elongate, glossy, somewhat silky. Sides regular, apex narrowly rounded. Whorls  $6\frac{1}{2}$ , convex, gradually increasing, first  $1\frac{1}{2}$  or 2 sculp-

tured with deep microspiral grooves, from 10 to 12 on 2nd whorl, remainder with close, curved, little raised vertical lirae; in fresher specimens the spiral striation continues, intersecting the lirae, for a short distance into the 3rd whorl, when it fades gradually away; suture well defined. Aperture piriform, labrum erect, a little arcuate in profile, columella straight, margin reflexed, forming a small rima, which does not appear, however, to be a constant feature.

Long. 7.0, lat. 2.25; apert. alt. 1.8, lat. 0.8; last whorl 3.75 mm.

Hab. S. RHODESIA. Victoria Falls (Connolly).

Type in British Museum.

Four specimens from two different localities, the other three measuring  $5.5 \times 2.0$ ,  $4.5 \times 1.8$ , and  $3.5 \times 1.75$  mm. respectively; the eggs are extremely small.

#### Pseudopeas burnupi (Conn.).

1919. Opeas burnupi Conn., Proc. Mal. Soc., xiii, pp. 143, 144. F.D.

Shell very small, acuminate turriform, narrowly rimate, moderately glossy and silky. Sides regular, apex narrowly rounded. Whorls 6½, rather convex, gradually increasing, first 1½ engraved with very fine and close, regular, shallow microspiral grooves, remainder covered with close, prominent, regular, curved vertical striae; suture moderately impressed. Aperture acuminate ovate, labrum erect and moderately arcuate in profile, columella nearly straight, margin thickly and very narrowly reflexed, forming a minute rima.

Long. 5.4, lat. 1.8; apert. alt. 1.5, lat. 1.0; last whorl 2.9 mm.

Hab. NATAL. Karkloof; Nottingham Road; Bulwer; Inhluzani; Fort Nottingham (Burnup).

CAPE PROVINCE. The Gorge, Somerset East (type, Burnup); Thomas River, Cathcart (Farquhar).

Type in British Museum.

For some incomprehensible reason I overlooked the apical sculpture when I first examined this little shell, but the microspiral grooves are plainly evident and necessitate its transference to *Pseudopeas*; the grooves are far closer and finer than in the preceding species.

## Pseudopeas tenue Conn.

1923. Pseudopeas tenue Conn., A.M.N.H., xii, p. 642, pl. xix, f. 5. D.F.

Shell of moderate size, fusiform, rimate, smooth and glossy. Sides slightly convex, apex narrowly rounded. Whorls 6, flattish, last 2 increasing far more rapidly than the earlier, first 2 covered with very faint and close, regular, microspiral striolae, remainder with weak, regular, curved vertical striae, on which the spiral sculpture is visible throughout; suture shallow. Aperture subovate, labrum erect and well arcuate in profile, columella weak, rather concave, margin very narrowly reflexed, forming a minute rima.

Long. 7.5, lat. 2.5; apert. alt. 2.0, lat. 0.9; last whorl 4.2 mm.

Hab. NATAL. Krantzkop (type, Burnup).

ZULULAND. Eshowe (Burnup).

Type in British Museum.

Placed in *Pseudopeas* on account of its very noticeably spiralled apex, but its habit and form are those of a South African *Curvella*, and its eggs, comparatively large and only two or three in number, suggest affinity with that genus.

Genus *Hypolysia* M. & P., 1901 (A.M.N.H., viii, p. 318). Type *H. florentiae* M. & P.

Differs from *Opeas* in having filiform sutures on the later whorls and the last whorl evolute near the aperture, owing to strong forward arcuation for a short distance below the suture.

 $Hypolysia\ florentiae\ M.\ \&\ P.$ 

Ref. List No. 423.

1901. Hypolysia florentiae M. & P., A.M.N.H., viii, p. 318, pl. ii, f. 8. D.F.

Shell of moderate size, elongate turriform, narrowly rimate, smooth and glossy. Sides straight, apex narrowly rounded. Whorls 9, not very convex, gradually increasing, first 2 smooth, 3rd sculptured with faint, nearly straight, vertical striae, which become more curved on the 4th and then develop very strong forward arcuation to a point shortly below the suture, from which they curve gradually backward; early sutures simple, later strongly filiform and crenate. Aperture subquadrate, narrowly rounded at base, labrum so strongly arched forward as to appear evolute, following the curve of the sculpture, columella long, straight, erect, margin narrowly and closely reflexed, nearly obscuring the narrow rima. The type is immature; a full-sized topotype described above measures

Long. 11·2, lat. 3·1; apert. alt. 3·3, lat. 1·5; last whorl 5·7 mm.

Hab. NATAL. Durban (type, Burnup).

Widely distributed near the coast from Knysna and Keurbooms River in the Cape Province through Natal into Zululand, and extending inland to Grahamstown.

TRANSVAAL. Rustenburg District (McBean).

Type in British Museum.

The fragile evolute lip is usually broken, but the curve of the striation and filiform suture render this species easily distinguishable; it is far more glossy than that which follows.

Hypolysia annipacis (Conn.).

1919. Opeas annipacis Conn., Proc. Mal. Soc., xiii, pp. 143, 144. F.D.

Shell small, elongate turriform, umbilicate, rather dull. Sides regular, apex rounded. Whorls  $5\frac{1}{2}$ , rather flat, first  $1\frac{1}{2}$  smooth, remainder sculptured with strong, regular, curved vertical costulae, which increase in subsutural arcuation, though not quite to the same extent as in florentiae, and are crossed by very close, fine, regular, microspiral lines; later sutures filiform, crenate. Aperture acuminate ovate, labrum strongly arcuate for a short distance from the suture and slightly inflexed before recurving to the base, columella nearly straight, margin moderately reflexed over the narrow umbilicus.

Long. 5.7, lat. 1.8; apert. alt. 2.0, lat. 0.8; last whorl 3.3 mm.

Hab. NATAL. Verulam (Cawston).

Type in British Museum.

The filiform suture of the last 3 whorls proves this small species to belong to *Hypolysia*; it differs from *florentiae* in smaller size, dull texture, and stronger sculpture.

Genus Curvella Chaper, 1885
(Bull. Soc. Zool. Fr., x, pp. 48, 49)
(= Hapalus Albers, 1850, non Billberg, 1820).
Type Curvella sulcata Chaper.

Shell acuminate ovate or subulate, spire comparatively short, apex normally smooth, transverse striae more or less curved, microspiral lineation, when existent, so weak as to be negligible, labrum arched forward in profile, retracted at each extremity, columella not truncate; central tooth of radula narrow, laterals tricuspid, eggs in most South African species round and comparatively large.

Some South African forms have an unexplained partiality for living in an ants' nest, the type locality of *majubana* being one half-way up the mountain, where I collected it breeding happily on two separate occasions at nearly a year's interval, while *elevata* flourishes in another nest on Grahamstown Commonage.

The species under present notice can be divided into three rather arbitrary groups according to strength of sculpture, while further method of differentiating them is by form of apex, whether very fine (croslyi, majubana, etc.) or rounded.

(i) Shell more or less strongly costulate or striate.

## Curvella nyasana Smith.

1899. Curvella nyasana Smith, P.Z.S., p. 588, pl. xxxiii, f. 44. D.F.

1906. Curvella nyasana Smith, Pilsb., Manual, xviii, p. 56, pl. ix, f. 50. D.F.

1925. Curvella nyasana Smith, Conn., Trans. R. Soc. S. Africa, xii, p. 182. N.

Shell of fair size, acuminate ovate, umbilicate, with silky sheen. Sides straight, apex narrowly rounded. Whorls  $6\frac{1}{2}$ , little convex, regularly increasing, first 2 smooth, remainder bearing strong, close, curved, vertical costulae; suture well defined. Aperture subquadrate, labrum erect and moderately arcuate in profile, columella straight, erect, margin rather broadly reflexed over the umbilicus. The type measures

Long. 12.2, lat. 6.3; apert. alt. 5.4, lat. 2.6; last whorl 8.7 mm.

Hab. LORENZO MARQUES. District north of Macequece, 4500 feet; Mtisherra River Valley (Cressy).

Type in British Museum.

Described from Mt. Chiradzulu and recorded from other localities in Nyasaland; the various local races vary slightly in size and contour. This is one of many rather large forms to be found in tropical Africa, differing considerably from the smaller purely South African species.

#### var. smithi n.

1899. Curvella nyasana var., Smith, P.Z.S., p. 588. D.

1925. ,, disparilis Smith, Conn., Trans. R. Soc. S. Africa, xii, p. 183. N. (Err. det.)

More egg-shaped than type, the early whorls and spire comparatively shorter, aperture longer and the sides very slightly convex. The shell described by Smith, from Zomba Plateau, is an overgrown giant with 7 whorls,  $18.5 \times 8.0$  mm., but the average size of examples under present notice, with 5 moderately convex whorls, is Long. 11.0, lat. 5.6; apert. alt. 5.4, lat. 2.8; last whorl 8.0 mm.

Hab. LORENZO MARQUES. Mtisherra R. Valley; Dondo District; Zangwe Basin (Cressy).

Type in British Museum.

This is the form I attributed in 1925 to *C. disparilis* (Smith), but on careful reconsideration I withdraw that opinion and refer it to the unnamed variety of *nyasana* mentioned by Smith in 1899, which I have pleasure in dedicating to him; the costulae are less crisp than in *disparilis* and less recurved below the suture, but agree well with the Zomba form.

# Curvella caloglypta M. & P. Ref. List No. 412.

1901. Curvella caloglypta M. & P., A.M.N.H., viii, p. 320, pl. ii, f. 12. D.F.

Shell very small, acuminate ovate, subrimate, with silky sheen. Sides regular, apex narrowly rounded. Whorls 5, moderately convex, first  $\frac{3}{4}$  minute, smooth, remainder sculptured with strong, moderately close, regular, straight vertical costae, which are half as distant again on the next as on the succeeding whorl and

then widen apart again, and such exceedingly fine, close, faint microspiral lineation as to be practically negligible; suture subcrenulate. Aperture subquadrate, labrum erect and moderately arcuate in profile, columella straight, erect, margin very closely reflexed, almost obliterating the minute rima. The type measures

Long. 4.6, lat. 2.85; apert. alt. 2.4, lat. 1.3; last whorl 3.8 mm.

Hab. NATAL. Pietermaritzburg (Burnup).

Type in British Museum.

Except for the extreme apex being smooth, the strong transverse costulation, extending on to the 1st whorl, would justify a special section for this small species, which differs in this respect from any other member of the genus known to me.

# Curvella euglypta sp. n. (Pl. viii, f. 5.)

Shell small, acuminate ovate, umbilicate, with silky sheen. Sides straight, apex narrowly rounded. Whorls 5, not very convex, first 1\frac{3}{4} smooth, but for faintest suggestion of exceedingly weak, fine, close, regular, microspiral lines, remainder bearing strong, regular, broad, vertical striae, close and straight at first and gradually becoming slightly curved and less close, while the microspiral lineation of the apex continues weakly over the entire surface; suture well defined. Aperture irregularly quadrate, labrum erect and moderately arcuate in profile, columella straight, inclined slightly inwards, margin triangularly reflexed over the narrow umbilicus.

Long. 7.2, lat. 3.9; apert. alt. 3.4, lat. 1.8; last whorl 4.8 mm.

Hab. NATAL. Van Reenen (Burnup).

Type in British Museum.

Somewhat resembling globosa in form, but with far stronger sculpture, the new species is similar in the latter respect to the tropical ovata Putz., a larger, more oviform shell with longer whorls.

(ii) Striation weaker than in Group (i), but easily visible under a weak lens.

# Curvella croslyi Bnp. Ref. List No. 414.

1905. Curvella croslyi Bnp., Proc. Mal. Soc., vi, p. 302, pl. xvi, f. 3-4. D.F.

Shell comparatively large, subulate, subrimate, glossy, nearly smooth; sides straight, apex narrowly rounded. Whorls 7, nearly flat except the last 2, regularly increasing, first 2 or 3 apparently smooth, remainder sculptured with faint, fine, curved, vertical striolae, crossed by extremely fine, close microspiral lines; suture well defined. Aperture quadrate, narrowly rounded at base, labrum vertical and evenly arcuate in profile, columella straight, nearly vertical, thickened upward, margin so narrowly and closely reflexed that there is little or no rimation.

Long. 12.0, lat. 5.2; apert. alt. 5.3, lat. 2.5; last whorl 7.8 mm.

Hab. ZULULAND. Makowe (Crosly).

Type in British Museum.

Immature shells are narrowly umbilicate; the eggs are spheroid, about 1.3 mm. across.

Curvella majubana Conn.

Ref. List No. 417.

1910. Curvella majubana Conn., A.M.N.H., vi, p. 270, pl. vi, f. 13. D.F.

Shell small, conic ovate, narrowly umbilicate, glossy, nearly smooth. Sides straight, apex very narrowly rounded. Whorls 6, slightly convex, first 2 smooth, remainder sculptured with very fine, close, regular, curved vertical striae; suture well defined. Aperture subovate, labrum erect and evenly arcuate in profile, columella straight, margin narrowly reflexed, nearly concealing the umbilicus.

Long. 9.6, lat. 3.4; apert. alt. 3.5, lat. 1.6; last whorl 5.3 mm.

Hab. NATAL. Majuba (type, Connolly). CAPE PROVINCE. Alicedale (Cruden).

Type in British Museum.

Far smaller than the preceding, and easily distinguished from other local species by its very symmetrical form with acute apex.

# Curvella straminea Bnp.

Ref. List No. 421.

1905. Curvella straminea Bnp., Proc. Mal. Soc., vi, p. 303, pl. xvi, f. 5-6. D.F.

Shell small, subulate, rimate, glossy, slightly silky. Sides straight, apex narrowly rounded. Whorls 6, not very convex, first 3 smooth, remainder sculptured with close, regular, vertical striolae, nearly straight at first and increasing in arcuation on the last 2 whorls; suture well defined. Aperture suboval, labrum erect and gently arcuate in profile, columella straight, erect, margin triangularly reflexed over the rima.

Long. 6.7, lat. 2.9; apert. alt. 2.5, lat. 1.25; last whorl 4.3 mm.

Hab. CAPE PROVINCE. Walmer, Port Elizabeth (Miss Hickey). Type in British Museum.

A graceful species, with slightly broader apex than the foregoing.

Curvella succinea Bnp. Ref. List No. 422.

1905. Curvella succinea Bnp., Proc. Mal. Soc., vi, p. 303, pl. xvi, f. 7–8. D.F.

Differs from straminea in narrower rimation, smoother and more glossy surface, flatter whorls and finer apex;  $5\frac{1}{2}$  flattish whorls, sculptured all over with negligibly faint microspiral lineation and, on the later, very fine and faint, close, curved, regular, vertical striolae; suture well defined. Aperture subquadrate, labrum erect and little arcuate in profile, columella straight, erect, margin very narrowly and closely reflexed, almost concealing the minute rima.

Long. 6.2, lat. 2.5; apert. alt. 2.5, lat. 1.2; last whorl 3.9 mm.

Hab. CAPE PROVINCE. Maeström Forest, Bedford (Farguhar). Type in British Museum.

# Curvella sinuosa M. & P. Ref. List No. 420.

1899. Curvella sinuosa M. & P., A.M.N.H., iv, p. 198, pl. iii, f. 12. D.F.

Shell small, subulate, rimate, glossy, slightly silky. Sides very slightly convex, apex narrowly rounded. Whorls 6, rather rapidily increasing, nearly flat except 4th and 5th, the last deeply grooved for a distance of 2 mm. backward from the lip, 0.75 mm. below and parallel to the suture; first 2 smooth, remainder sculptured with close, fine, regular, arcuate vertical striae; suture somewhat impressed. Aperture subpiriform, labrum well arcuate, incurved over the aperture at end of groove and receding thence somewhat to base, columella straight, margin extremely narrowly reflexed over the small rima. The type measures

Long. 5.5, lat. 2.8; apert. alt. 2.4, lat. 1.1; last whorl 4.25 mm.

Hab. NATAL. Umkomaas (Burnup).

Type in British Museum.

I have no knowledge whether more than a single specimen was collected, but the groove and consequent labral sinuation suggest deformity; the shell differs from the last 4 in its flatter, more rapidly increasing whorls.

(iii) Smooth shells with sculpture hardly visible to the naked eye. It may be convenient to deal with this group in order of obesity, beginning with the broadest.

# Curvella globosa (M. & P.). Ref. List No. 416.

1898. Hapalus globosus M. & P., A.M.N.H., ii, p. 128, pl. vii, f. 6. D.F.

Shell small, acuminate ovate, subrimate, smooth and glossy. Sides regular, apex narrowly rounded. Whorls 5, convex, rapidly increasing, first 2 smooth, remainder bearing very weak, close, moderately curved vertical striolae; suture well defined. Aperture subquadrate, labrum erect and little arcuate in profile, columella straight, erect, margin closely reflexed, practically obliterating the rima. The type measures

Long. 6.0, lat. 3.2; apert. alt. 3.2, lat. 1.6; last whorl 4.7 mm.

Hab. NATAL. Stella Bush, Durban (type, Burnup); Sinkwazi Beach (Puzey).

CAPE PROVINCE. York Drakensberg, Griqualand East (Farquhar).

ZULULAND. Eshowe bush (Burnup).

Type in British Museum.

Easily recognisable by its obese contour and smooth glossy surface.

# Curvella catarractae (M. & P.).

Ref. List No. 413.

1897. Hapalus catarractae M. & P., A.M.N.H., xix, p. 635, pl. xvii, f. 4. D.F.

Shell very small, acuminate ovate, narrowly rimate, smooth and glossy. Sides regular, apex narrowly rounded. Whorls 5\(\frac{1}{4}\), convex, sculptured with negligible microspiral lineation and, on later whorls, extremely weak growth striolae; suture well defined. Aperture quadrate, rounded at base, labrum erect and little arcuate in profile, columella straight, erect, margin narrowly and closely reflexed, almost obscuring the narrow rima. The type measures

Long. 5.2, lat. 2.9; apert. alt. 2.25, lat. 1.1; last whorl 3.4 mm.

Hab. NATAL. Howick (type); Equeefa; Inchanga; Botanical Gardens, Pietermaritzburg; Alexandra Park (Burnup); Durban (Penther); Winkel Spruit (Akerman).

CAPE PROVINCE. Pirie River (Godfrey).

Type in British Museum.

# Curvella elevata Bnp.

Ref. List No. 415.

1905. Curvella elevata Bnp., Proc. Mal. Soc., vi, p. 304, pl. xvi, f. 10-11. D.F.

Shell small, subulate, rimate, smooth and glossy. Sides typically straight, apex rounded. Whorls  $6\frac{1}{2}$ , rather flat, the later sculptured with very faint, curved, erect striolae and traces of negligible microspiral lineation; suture rather shallow. Aperture short, suboval, labrum erect and not much arcuate in profile, columella straight, inclined slightly inwards, margin triangularly reflexed over the rima. The type is not full grown; my largest typical example from Grahamstown, ex Farquhar, measures

Long. 7.9, lat. 3.6; apert. alt. 2.8, lat. 1.5; last whorl 4.7 mm.

Hab. CAPE PROVINCE. Grahamstown (Farquhar).

Type in British Museum.

The produced spire with straight sides, comparatively blunt apex, and short aperture distinguish this species from others of its size.

# Curvella farquhari Conn.

1919. Curvella farquhari Conn., Rec. Albany Mus., iii, pp. 217, 219. F.D.

Shell small, conical, umbilicate, smooth and glossy. Sides regular, apex narrowly rounded. Whorls 4½, slightly convex, rapidly increasing, first 2 smooth, remainder sculptured with very faint, fine, close, slightly curved vertical striolae; suture shallow. Aperture nearly oval, labrum erect and slightly arcuate in profile, columella slightly concave, margin triangularly reflexed over the umbilicus.

Long. 5.6, lat. 3.2; apert. alt. 3.0, lat. 1.6; last whorl 3.9 mm.

Hab. CAPE PROVINCE. Mountain Drive, Grahamstown (Farquhar; Kincaid).

Type in Albany Museum, Grahamstown.

The last whorl is much less globose than in *globosa*, while the pointed apex distinguishes this species from *elevata* and absence of spiral sculpture from *succinea*.

### Curvella saundersae Conn.

Ref. List No. 419.

1910. Curvella saundersae Conn., A.M.N.H., vi, p. 270, pl. vi, f. 14. D.F.

Shell small, conic ovate, rimate, smooth and glossy. Sides straight, apex rounded. Whorls  $5\frac{1}{2}$ , slightly convex, first 2 smooth, remainder sculptured with very weak, close, curved vertical striolae, cut by exceedingly fine, close, regular, microspiral lines, only discernible under high magnification; suture well defined. Aperture subovate, labrum erect and slightly arcuate in profile, columella straight, margin narrowly reflexed.

Long. 7.6, lat. 3.4; apert. alt. 3.2, lat. 1.5; last whorl 4.9 mm.

Hab. ZULULAND. Eshowe (type, Lady Saunders); Mfongosi (Jones).

Type in British Museum.

More slender than foregoing members of its group, and nearest *majubana*, from which it differs in its blunter apex and fainter striation.

#### Curvella modesta Conn.

Ref. List No. 418.

1910. Curvella modesta Conn., A.M.N.H., vi, p. 271, pl. vi, f. 15. D.F.

Shell small, subulate, rimate, smooth and glossy. Sides straight, apex narrowly rounded. Whorls  $5\frac{1}{2}$ , rather convex, first  $1\frac{1}{2}$  smooth, remainder sculptured with fine, regular, curved vertical striolae, hardly visible without a lens; suture well defined. Aperture subovate, labrum erect and slightly arcuate in profile, columella slightly concave, margin narrowly reflexed. The type measures

Long. 6.8, lat. 2.8; apert. alt. 2.5, lat. 1.2; last whorl 4.0 mm.

Hab. CAPE PROVINCE. Dassie Krantz, Grahamstown (type); Cradock Commonage (Farquhar); Table Hill (ex coll. Ponsonby).

Type in British Museum.

The narrowest member of the sculptureless group, very like majubana but with weaker striation.

### Sub-species compsotera Conn.

1923. Curvella modesta, sub-spec. compsotera Conn., A.M.N.H., xii, p. 641. D.

Very slightly more slender and graceful than the typical form, with 6 flattish whorls, transverse striolation as in type, and signs of extremely fine and faint microspiral lineation.

Long. 6.5, lat. 2.3; apert. alt. 2.0, lat. 1.1; last whorl 3.7 mm.

Hab. NATAL. Osborn (type, Pocock). CAPE PROVINCE. Cathcart (in British Museum ex coll. Wotton). Type in British Museum.

Genus Xerocerastus Kob. & Mlldff., 1902 (= Eburnea Mouss., 1887, non Fleming, 1828).

At the moment when this work was on the point of publication in September 1937, there came to hand a large amount of anatomical material relating to many species and races of this genus, of so great importance as to entail its thorough revision, at a length which is out of all proportion to the space allotted to other groups in the body of the work.

It was therefore decided that treatment of the entire group of *Xerocerastus* should be incorporated in a supplement, to appear soon after the present publication, and further mention of it is omitted from this page.

Subfamily Coeliaxinae Pilsb., 1904.

Shell long and narrow, perforate; whorls numerous, with internal lamellae; aperture relatively small.

Genus Coeliaxis Ad. & Ang., 1865. Monotype C. layardi Ad. & Ang. (blandi Pfr.)

(= Bathyaxis Ancey, 1887 and Sphalerostoma Girard, 1892).

Shell characters as in monotype; radula with narrow central tooth, laterals and marginals without inner cusps; animal ovoviviparous.

Coeliaxis blandi (Pfr.).

Ref. List No. 454 (as layardi).

1852. Bulimus blandi Pfr., P.Z.S., p. 85. D.

1854. ,, ,, ,, Conch. Cab., p. 155, pl. xviii, f. 15-16. D.F.

1865. Subulina (Coeliaxis) layardi, Ad. & Ang., P.Z.S., p. 54, pl. ii, f. 1. D.F.

1929. Coeliaxis blandi Pfr. (=layardi Ad. & Ang.), Conn., Ann. Natal Mus., vi, p. 237.  $\,N.$ 

1931. Coeliaxis layardi Ad. & Ang., Thiele, Handb. Syst. Weicht.-k., p. 556. D.

Shell rather large, elongate turriform, umbilicate, thin, asperate, transparent, stramineous olivaceous. Spire much produced, narrowing considerably upward from the 14th to 6th whorl, apex rounded. Whorls 20, nearly flat, slowly increasing, first 11 nearly equal in breadth, remainder increasing less slowly, rounded at periphery of mature shells, but angulate, owing to the base being nearly flat. until maturity; 1st whorl practically smooth, remainder covered all over with strong, close, regular, straight, slightly oblique transverse costae, weaker on the flattened base of young shells; suture simple, well defined. Aperture short, subquadrate, rounded at base, with a tendency to slight thickening when complete, labrum straight and receding somewhat in profile, columella short, erect, margin thickly reflexed, axis hollow, with an inrunning lamella nearly half way up the columella, usually beginning just too far inside the shell to be visible from the aperture, and becoming stronger about the antepenultimate whorl, where there originates a strong inrunning fold on the upper, and another, overlapping it, on the lower wall, none of these, however, persisting within the narrow upper whorls; umbilicus narrow, callus, when present, rather thin.

Long. 30.6, lat. 7.0; apert. alt. 4.8, lat. 2.7; last whorl 7.5 mm.

Hab. CAPE PROVINCE (layardi, fide Adams and Angas); Tharfield (Layard); Kowie (Bowker); Port Alfred; East London (Farquhar); Port Elizabeth (Crawford); Kasouga (Hewitt); Mossel Bay; Kwelegha Mouth (Power).

TRANSVAAL. The record given in my Reference List can be expunged.

Type of blandi and paratypes of layardi in British Museum.

C. blandi was described from a shell in the Cuming collection purporting to hail from "Baranguilla, in the Colombian Andes," but the type is simply a rather immature example of the well-known Cape species, and the Cuming locality obviously incorrect; one of two paratypes of layardi in the British Museum bears a prominent square denticle near the right extremity of the paries, but this is probably an accidental feature.

The base of immature shells is nearly flat, the periphery at that point, therefore, strongly angulate and the basal margin a straight

line, sloping a little downward to the left, while the sculpture is far weaker than on the rounded base of full-grown shells.

# Sub-species kincaidi Conn.

1923. Coeliaxis layardi Ad. & Ang., sub-sp. kincaidi Conn., A.M.N.H., xii, p. 657, pl. xix, f. 23. D.F.

Differs from type in its more slender form, shorter whorls, and continuous peristome. The callus is opaque white, straight, and so thick that it is continuous; the shell contains  $22\frac{1}{2}$  whorls and measures  $30.5 \times 6.5$  mm.; another contains  $21\frac{1}{2}$  whorls in a length of 28.2 mm.

Hab. CAPE PROVINCE. East London (Kincaid). Type in British Museum.

#### FAMILY FERUSSACIIDAE.

Shell small, subulate or narrowly ovate, imperforate, usually smooth and glossy; whorls laterally flattened, columella often folded or truncate. Foot with well marked fringe; mantle with a large gland above the respiratory opening; kidney extending up the back of the lung and then forward to some extent beside the rectum; jaw as in the Bulimulidae; radula as in the Subulininae.

Genus Cecilioides Fér., 1807 (Essai d'un Méth. Conch., p. 77). Type Buccinum acicula Müll.

(=Caecilioides auctt., Caecilionella Bgt., 1856, etc.).

Shell minute, acicular, imperforate, smooth, glossy, transparent, palest olivaceous, with obtuse apex and few oblique whorls, columella typically truncate; animal white, eyeless, genital organs simple, penis club-shaped, without appendix.

Cecilioides acicula (Müll.).

(Pl. viii, f. 12.)

Ref. List No. 408.

1774. Buccinum acicula Müll., Verm., ii, p. 150. D.

1916. Caecilioides acicula Müll., Conn., Ann. S.A. Mus., xiii, p. 188. N.

1928. Cecilioides acicula Müll., Wats., J. of C., xviii, p. 217, pl. v,

f. 1–7. D.F.A.R.

1929. Caecilioides acicula Müll., Wächtler, Arch. f. Moll.-k, lxi, p. 1. Ecology.

1929. Caecilioides acicula Müll., Wächtler, Zeitschr. Morph. u. Oekol. Tiere, xiii, p. 359. D.F.A.R.

1929. Cecilioides acicula Müll., Watson, J. of C. xviii, p. 305. A.R. 1930. Cecilioides acicula Müll., Conn., Ann. S.A. Mus., xxix, p. 297. L.

(I omit the extensive synonymy and other recent references to this species.)

Shell minute, acicular, imperforate, smooth and glossy, vitreous. Sides straight, apex narrowly rounded. Whorls 6, nearly flat, increasing regularly in length but little in breadth, practically smooth, the transverse striolation so faint as to be almost non-existent and microspiral lineation only just traceable in freshest specimens under strong magnification; suture oblique, very shallow, narrowly margined below. Aperture elongate pyriform, labrum vertical and very slightly curved in profile, columella erect, very slightly concave, narrowly arcuately truncate at base, callus continuous, transparent. The shell described, from Kimberley, measures Long. 5·7, lat. 1·7; apert. alt. 1·7, lat. 0·7; last whorl 3·2 mm.

Hab. CAPE PROVINCE. Cradock (in coll. Bryant Walker); Prieska (Gibbons; Gould).

CAPE PENINSULA. Wynberg (Connolly).

TRANSVAAL. Pietpotgietersrust (Connolly).

ORANGE FREE STATE. Bloemfontein (Connolly).

DAMARALAND. Outjo; Namutoni; Cauas Okawa (Barnard).

KAOKOVELD. Ombombo; Kaoko Otavi (Barnard).

GRIQUALAND WEST. Kimberley (Swan).

OVAMBOLAND. Ukualuthi (Barnard).

Paratype in Copenhagen Museum.

Jaw crossed by numerous folds which denticulate the edges; central tooth of radula small and narrow with a short mesocone flanked by 2 minute ectocones, laterals larger, tricuspid, marginals rather broad, bearing 6-7 minute denticles, formula about  $(10+5+1+5+10)\times 81$ .

Higher authorities than myself have kindly examined specimens from most of the above mentioned localities and agree that they are not separable, on conchological grounds, from the common European species, which, if once introduced into South Africa, owing to its minute size and light weight might easily become widely distributed by means of the dust storms which add so greatly to the pleasure of existence in that delectable climate.

Cecilioides advena (Ancey).

Ref. List Nos. 409 and 411.

1888. Coecilionella advena Ancey, Le Naturaliste, x, p. 215. D. 1892. Cionella ovampoensis M. & P., A.M.N.H., ix, p. 91, pl. vi, f. 1. D.F.

1925. Caecilioides ovampoensis M. & P., Conn., Trans. R. Soc. S. Africa, xii, p. 186.  $\,N.$ 

1930. Cecilioides advena Ancey (=ovampoensis M. & P.), Conn., Ann. S.A. Mus., xxix, p. 297. N.

The type of ovampoensis is similar in all respects to the South African form which I refer to acicula, except that its columella is distinctly concave and basal truncation accordingly more pronounced, but this feature varies in shells of acicula from other localities and cannot be regarded as of specific value; in the other shell of the type pair of ovampoensis there is a spiral fold on the upper part of the columella, which Ancey emphasizes in his description of advena, but Watson (1928) mentions as a frequent feature in young shells of acicula, usually disappearing when the snail is half grown, though it occasionally persists to a later stage. Ancey's type is said to have a little more than 5 whorls and to measure

Long. 4.5, lat. 1.25; apert. alt. 1.5, lat. 0.6 mm.

Hab. OVAMBOLAND (ovampoensis in coll. Layard); Disappointment Vlei (advena, Andersson & Chapman).

LORENZO MARQUES. Matolla (ovampoensis, Penther, fide Sturany).

Type of advena ubi?, ovampoensis in British Museum.

I would have no hesitation in uniting this species, which was founded by both Ancey and M. & P. on examples collected by Andersson and Chapman in the same locality, with acicula, were it not for the possibility that my identification of the latter may prove, on further acquaintance, to be incorrect, in which case Ancey's specific name will probably be applicable to the South African forms; the many occurrences of acicula recorded above from South-West Africa add to the probability of the two being conspecific.

Cecilioides gokweanus (O. Bttg.). (Pl. viii, f. 14–17.) Ref. List No. 410.

1870. Cionella gokweana Bttg., Ber. Offenbach. Ver. f. Naturk., xi, p. 47, pl. i, f. 2. D.F.

Easily distinguishable by the shortness and squarely rounded base of the aperture in more or less adult shells. My largest specimen from Pienaars Poort has 4 flattish whorls with no transverse, but very fine, close microspiral sculpture on the later whorls; suture not margined. Aperture short, labrum scarcely arched forward, but receding considerably half-way down, columella long, erect, nearly straight, merging into basal margin with practically no trace of truncation.

Long. 3.5, lat. 1.2; apert. alt. 1.1, lat. 0.7; last whorl 2.25 mm.

Hab. BECHUANALAND. Gokwe River (type, Hubner). TRANSVAAL. Pienaars Poort (Connolly). Type in Senckenberg Museum.

C. tribulationis Preston \* from Naivasha is probably identical with this species, to which small individuals in my collection from the Victoria Falls and more northern localities appear referable, but are too immature for exact identification.

# Cecilioides pergracilis sp. n.

(Pl. viii, f. 13.)

Shell very small, acicular, imperforate, smooth and glossy, milky olivaceous. Spire unusually narrow, sides regular, apex domed. Whorls 6, nearly flat, 1st minute, 2nd and 3rd nearly equal, last 3 rapidly increasing in length, sculpture so faint as to be practically negligible, though most exceedingly close, fine, regular, microspiral lineation is just perceptible, especially inside the shell, under high magnification; suture oblique, shallow. Aperture narrow acuminate piriform, labrum vertical and evenly curved forward in profile, base rounded, columella short, erect, clearly truncate near base of shell, and extending across the paries in a distinct callus.

Long. 4·4, lat. 1·3; apert. alt. 1·3, lat. 0·5; last whorl 2·3 mm.

Hab. ZULULAND. Mfongosi (type, Jones).

NATAL. Isipingo (Alexander).

Also collected by H. J. Snell in Zanzibar.

Type in British Museum.

I cannot reconcile this with any other African species, though most are so poorly figured and described that it is no easy task to identify them; the more slender contour and oblique sutures of the last 3 whorls make it easily recognizable. It may be near the Indian balanus Rve., which appears, however, to have less sloping sutures.

#### FAMILY CLAUSILIIDAE Stoliczka, 1871

(J. Asiatic Soc. Bengal, xl, p. 173).

As in the case of Succineidae, the sponsorship of this family name antedates so greatly that given in my Reference List that I think it worth publishing above.

Shells usually sinistral, of no great size, elongate, narrow, fusiform, with many whorls and small aperture, containing various internal folds and usually a clausilium, or peculiar elongate plate formed within the last whorls of the shell for the purpose of closing the aperture, attached to the columella by an elastic spirally twisted pedicle, unlike the operculum in the Streptoneura, which is attached to the animal.

<sup>\*</sup> Rev. Zool. Afr., i, 1911, p. 220.

Genus Austrobalea Pilsb., 1924 (Nautilus, xxxviii, p. 6). Type Balea africana M. & P. Interior fold very weak; clausilium absent.

> Austrobalea africana (M. & P.). (Pl. xii, f. 1.) Ref. List No. 364.

1899. Balea africana M. & P., A.M.N.H., iv, p. 198, pl. iii, f. 10. D.F.

1924. Balea africana M. & P., Pilsb., Nautilus, xxxviii, p. 6. N.

Shell of moderate size, sinistral, narrow fusiform, rimate, silky, dark corneous brown with patches of short white lines on the striae at entirely irregular intervals. Spire produced, sides convex, apex narrowly rounded. Whorls 7, nearly flat, regularly increasing, first 2 smoothly malleate, remainder sculptured with strong, close, regular, slightly undulating vertical costulae; suture simple, shallow. Aperture subrhombic, rounded at base, peristome white, slightly expanded, labrum straight and erect in profile, columella erect, margin white, reflexed, with a weak, blunt, entering fold, arising well within the aperture, running upwards and inwards from the centre of the columella. A Karkloof example measures

Long. 7.8, lat. 2.5; last whorl 3.6 mm.

Hab. NATAL. Van Reenen (type, Quekett); Karkloof (Burnup). CAPE PROVINCE. Bedford (Farquhar); Pirie Forest (Godfrey). Type in British Museum.

### FAMILY VALLONIIDAE.

Minute orthurethrous snails with perforate shells of few whorls, usually without internal laminae. Animal oviparous or viviparous, with long penial appendage, retractor muscle usually bifurcate, prostate gland short and posterior, terminal male organs often wanting. Jaw thin with flat vertical plates, central tooth more or less tricuspid, laterals bicuspid, marginals pectinate.

Genus Vallonia Risso, 1826 (Hist. Nat. Eur. Mérid., iv, p. 101). Type V. rosalia Risso (pulchella Müll.).

Shell extremely small, umbilicate, depressed globose, practically colourless, with rounded periphery and reflexed or expanded peristome.

# Vallonia pulchella (Müll.).

Ref. List No. 298 (as excentrica Sterki).

1774. Helix pulchella Müll., Verm., ii, p. 30. D.

1850. " " " Bs., A.M.N.H., v, p. 217. L.

1879. ,, ,, Gibb., J. of C., ii, p. 282. L.

1920. Vallonia pulchella Müll., Watson, Proc. Mal. Soc., xiv, pp. 6 et seqq., text-figs. 3b, 4d, 5c, 6d, e, f, k; pl. ii, f. 6. D.F.A.R.

1926. Vallonia pulchella Müll., K. & W., Syn. Brit. Moll., p. 136. Synonymy.

1935. Vallonia pulchella Müll., Gardner, Q. J. Geol. Soc. xci, p. 484, pl. xxx, f. 20–21. N.F.

Shell very small, depressed globose, umbilicate, thin, smooth, transparent, colourless or milky white. Spire little exserted, apex bluntly rounded. Whorls  $3\frac{1}{2}$ , rounded at periphery, regularly increasing, first  $1\frac{3}{4}$  practically smooth, remainder covered with close, rather coarse, curved, slightly oblique striae; suture simple, well defined. Aperture circular, peristome nearly free, abruptly reflexed, white and glossy, labrum receding gradually in profile, columella weak, concave, margin quite clear of umbilicus, which is wide, deep, and situated in the exact centre of the base.

Diam. maj. 2.5, min. 1.9; alt. 0.6 mm.

Hab. CAPE PENINSULA. High Constantia (Benson); Wynberg (Lightfoot); Cape Town (Gibbons; Layard).

CAPE PROVINCE. Somerset East (Miss Bowker); Grahamstown (Farquhar); Port Elizabeth (Crawford); King Williamstown (Miss Ross).

NATAL. Pietermaritzburg (Burnup).

TRANSVAAL. Pretoria (McBean).

Central tooth of radula small with a minute cusp on each side of the short mesocone, 3 laterals with large mesocone and single ectocone, next with 2 ectocones, following 8 with an increasing number of small cusps, outer marginals rudimentary; formula  $(9+4+1+4+9) \times 70$ .

A widely diffused species, doubtless introduced from Europe.

When my Reference List was in preparation examples of this species from several South African localities were submitted to one who was then considered the leading English authority on the genus, and he identified them all as excentrica. Recent examination has convinced Tomlin, Watson, and myself that all are pulchella, which must therefore replace Sterki's species in the local list.

### FAMILY PUPILLIDAE.

Small, usually elongate, corneous brown shells, with aperture edentulate or exhibiting an uncertain number of tooth-like processes which serve to a great extent in differentiating the genera and species. Pilsbry \* gives a comprehensive diagram showing the full arrangement and nomenclature of 18 such processes, but for present purpose it is sufficient to explain that he terms all those on the paries and columella lamellae and all on base and labrum folds or plicae, and that there are 6 main processes: angular lamella at angle of paries and labrum, parietal lamella about centre of paries, and columellar lamella about half-way up columella; upper palatal plica about bottom of sinulus, lower palatal plica beneath it, and basal plica about centre of base.

The following arrangement is based on that of Pilsbry's Manual, 1935.

# Subfamily GASTROCOPTINAE.

Animal oviparous, without penial accessory organs and with two pairs of tentacles; jaw as in Pupillinae. Shell with or without dental processes in the neanic stage, typically with angular, parietal and columellar lamellae and 2 or more palatal plicae.

Genus Gastrocopta Woll., 1878 (Test. Atlant., p. 515). Type Pupa acarus Bs. (=Bifidaria Sterki, 1891).

Shell perforate, cylindrical or conic ovate, angular and parietal lamellae converging or becoming completely concrescent, columellar lamella present, and usually also palatal folds. Foot short, tentacles rather short but distinct, sole not divided longitudinally.

Sub-genus Gastrocopta s.s. Gastrocopta damarica (Ancey). Ref. List No. 344.

1888. *Pupa damarica* Ancey, Le Naturaliste, x, p. 200. *D*. 1892. ,, *ovampoensis* M. & P., A.M.N.H., ix, p. 91, pl. vi, f. 11. *D.F*.

1901.  $Pupa\ ridibunda$  M. & P., A.M.N.H., viii, p. 320, pl. ii, f. 11. D.F.

\* Manual, xxiv, p. vii.

1894. Pupa microbus Morel., Dautz., Bull. Soc. Zool. Fr., xix, p. 129, pl. i, f. 5. D.F.

1917. Gastrocopta damarica Ancey, Pilsb., Manual, xxiv, pp. 125, pl. xxii, f. 14-16. D.F.

1918. Gastrocopta damarica Ancey, Pilsb., ibid., p. 359, pl. xlvi, f. 12. N.F.

1925.  $Gastrocopta\ damarica\ Ancey\ (=microbus\ Morel.)$ , Conn., A.M.N.H., xv, p. 467. N.

1930. Gastrocopta damarica Ancey, Conn., Ann. S.A. Mus., xxix, p. 293. L.

Shell very small, nearly cylindrical, rimate, thin, silky, transparent, pale corneous brown. Spire produced, apex mamillate. Whorls 5, very convex, gradually increasing, first  $2\frac{1}{8}$  practically smooth, remainder sculptured with faint, straight, slightly oblique transverse microscopic striolae; suture simple, impressed. Aperture quadrate, rounded at base, peristome slightly expanded, labrum straight and scarcely recurved, columella erect, callus thin but continuous; dentition 5-fold; a strong, shortly inrunning angular lamella; a small inset sinular denticle; a stronger, equally inset, lower palatal fold; a small basal denticle and a stronger horizontal one half-way up the columella, the last 4 processes all situate well within the aperture. The shell described, from Pienaar's Poort, measures

Long. 2.25, lat. 0.95; apert. alt. 0.75; last whorl 1.25 mm.

Hab. OVAMBOLAND (ovampoensis, in coll. Layard); Disappoint ment Vlei (damarica, Andersson & Chapman).

GREAT NAMAQUALAND. Diab R. (Edlinger); Aiais (Hesse & Thorne).

DAMARALAND. Outjo; Narebis; Nuragas; Usakos (Barnard); Upper Epukiro (Edlinger).

KAOKOVELD: Kaoko Otavi (Barnard).

S. RHODESIA. Victoria Falls (Soper).

TRANSVAAL. Rustenberg (McBean); Potchefstroom (Miss Livingston); Pretoria; Heidelberg; Buiskop; Pietersburg; Pruizen (Connolly).

ORANGE FREE STATE. Bloemfontein (Connolly); Thaba Nchu (fide Falcon).

CAPE PROVINCE. Prieska (Gibbons); Cradock (ridibunda); Port Elizabeth (Farquhar).

ZULULAND. Mfongosi (Jones).

Type of damarica ubi (?); ovampoensis and ridibunda in British Museum.

The sculpture varies greatly in strength, the striae in some examples rising at fairly regular intervals into rather distant costulae, while the lower palatal lamella is sometimes a mere tubercle and sometimes a short inrunning fold. The angular lamella is usually bilobed, with a distinct depression between its two ends.

### Gastrocopta thomasseti Pilsb.

1929. Gastrocopta thomasseti Pilsb., Ann. Natal Mus., vi, p. 301, pl. xx, f. 5–6. D.F.

1931. Gastrocopta thomasseti Pilsb., Manual, xxviii, p. 71, pl. xiv, f. 5-6. D.F.

Very similar to the more highly sculptured form of damarića, but normally with only 3-fold dentition, a more or less bilobed angular, and a rather strong, subhorizontal columellar lamella, and a moderately elongate lower palatal fold; a very few of the specimens examined showed a very small upper palatal, but none any trace of a basal fold. The shell consists of 5 whorls and measures from  $2\cdot15$  to  $2\cdot25$  mm. in length.

Hab. NATAL. Block Island, Weenen (Thomasset). Type in Academy of Natural Sciences, Philadelphia.

# Gastrocopta duplicata (Prest.). (Pl. x, f. 16.)

1911. Fauxulus duplicatus Prest., A.M.N.H., vii, p. 470, pl. xi, f. 22. D.F.

1917. Gastrocopta duplicata Prest., Pilsb., Manual, xxiv, p. 127, pl. xli, f. 3. D.F.

Shell sinistral, very small, acuminate ovate, rimate, smooth, moderately glossy, bright corneous brown. Spire produced, sides convex, apex narrowly rounded. Whorls 5, convex, gradually increasing, first 2 smooth, remainder covered with weak, oblique, microscopic growth wrinkles and striolae; suture well defined. Aperture roundly quadrate, peristome white, reflexed, dentition 5-fold; a long angular lamella running obliquely inwards and divided into two by a low col not far from its start, so that it appears like 2 distinct white plaits in the same straight line, one inset beneath the other, and 3 small white tubercles, all somewhat inset, half-way down the labrum, about centre of base and half-way up the columella respectively; columella erect, concave, margin triangularly reflexed.

Hab. TRANSVAAL. Leeuwfontein, 25 miles north of Pietersburg (Ziervogel); between Pietersburg and Piet Potgietersrust (subfossil, Geol. Survey of S. Africa).

Type in Tervueren Museum.

Alt. 3.8, lat. 1.5; last whorl 2.2 mm.

It is remarkable to find this species, only known, I think, from its original locality in Kenya Colony, occurring so far south, but the Transvaal shells, one of which is here described and figured, agree perfectly with those from Kenya. Except for the duplex parietal process, they are exact facsimiles of the likewise sinistral *Pupilla tetrodus* (Bttg.) and it is almost inconceivable that the two should belong to different genera.

# Genus Fauxulus Schaufuss, 1869

(Paetel's Catalogue, p. 15)

(=Faula H. & A. Adams, 1855, non Blandford, 1850).

Type Pupa capensis Küst.

Shell usually sinistral, rimate or perforate, cylindriform with conic summit, or acutely ovate, of many whorls; aperture normally with at least 5 teeth, 2 on paries, 1 on columella and 2 on labrum, and often others. Animal with 2 pairs of tentacles.

# Sub-genus Fauxulus s.s.

Only the angular lamella emerges to the lip edge, other teeth distinctly deeper; contour cylindriform or ovate; shell sinistral.

# Fauxulus capensis (Küst.).

(Pl. xii, f. 7.)

Ref. List No. 357.

1841. *Pupa capensis* Kurr, Küst., Conch. Cab., p. 10, pl. i, f. 19–20. *D.F.* 

1917. Fauxulus capensis Küst., Pilsb., Manual, xxiv, p. 236, pl. xxxix (1918), f. 1-4, 6, 9. D.F.

Shell sinistral, of medium size, rimate, acuminate ovate to cylindrical, according to length, smooth, calcareous, bluish white (rarely buff) with occasional small black dots and more rarely a thread-like black sutural line, which extends across the paries and around the periphery, or a broader yellow infrasutural girdle. Spire produced, sides from convex to straight and parallel, summit, 6-7 whorls, conical. Whorls 9-11, nearly flat, gradually increasing, later nearly equal, the 1st showing a few microscopic puckers, remainder bearing close, slightly irregular, slightly curved and oblique striae, usually crossed on the later whorls by a few distant spiral grooves; suture simple, shallow. Aperture quadrate, rounded at base, more or less fulvous within, peristome slightly expanded, dentition normally 5-fold; an inset parietal lamella; an angular lamella entering from the level of the labrum, with which it does not quite connect; a tooth nearly half-way down the labrum and another on left of base, and a horizontal lamella about half-way up the columella; there is occasionally a small additional denticle on right of base. The type measured about 7.9 × 3.4 mm., with from 9 to 10 whorls; a few specimens from the Cape Peninsula taken at random to show the range of variation measure respectively

Long. 6.0, lat. 3.0; last whorl 3.0 mm., 8 whorls 6.1 ,, 3.2 3.0 ,,  $8\frac{1}{2}$ ,, 7.5 ,, 3.33.75 ,, 9 ,, 7.8 ,, 3.4 3.6 ,, 10 ,, ,, 10 ,, 8.3 ,, 3.4 3.6,, ,, 10 8.5 ,, 3.0 3.7,, 11 9.0 ,, 3.8 4.2

On approaching Bredasdorp, however, although in most localities normal, F. capensis exhibits considerable departure, both in size and contour, from the foregoing dimensions and proportions: some cylindriform shells are longer, and some shorter ones more obese, a matter of deep importance when considering the proper treatment of this section, in view of the attempt on next page to restore F. ovularis Küst. to full specific rank. Two of three examples from Salt River are remarkable for the complete absence of columellar lamella and extreme weakness of the upper palatal plica, while they are unusually ventricose, measuring

Long. 7.4, lat. 4.0; last whorl 3.3 mm., 
$$9\frac{1}{2}$$
 whorls, and ,, 6.3 ,, 3.7 ,, 3.2 ,, 9 ,,

the third shell, however, is normal. Three examples from Elim Road measure respectively  $7.9 \times 3.1$ ,  $7.0 \times 3.0$ , and  $7.0 \times 3.5$  mm., and four from the dunes between Onrust and Hermanus are dimensionate

Long. 9·8, lat. 4·0; last whorl 5·3 mm.

,, 9·4 ,, 4·3 ,, 4·7 ,,

,, 9·0 ,, 4·3 ,, 4·7 ,,

,, 7·4 ,, 3·8 ,, 3·8 ,,

Hab. CAPE PROVINCE. Zoetendals Valley and Potteberg, Swellendam District (Krauss); Port Elizabeth (Crawford); Gordon's Bay (Connolly); St. Helena Bay; recent and fossil at Saldanha Bay (Lightfoot); dunes between Onrust and Hermanus; Elim Road, 5 miles S.W. of Bredasdorp; gorge of Salt R., Windhoek, Bredasdorp District (Rennie); Humansdorp (Rogers); Jeffreys Bay (Cruden); Knysna (Smith); Mossel Bay (Power).

BECHUANALAND. Kuruman (Moffatt, fide Layard).

GRIQUALAND WEST. Kimberley (Swan).

CAPE PENINSULA. Widely distributed; the buff variety and that with yellow infrasutural girdle are found at Buffelsfontein, Cape Point.

Type in Stuttgart Museum.

var. pottebergensis Küst.

(Pl. xii, f. 4.)

Ref. List No. 357.

1841. Pupa pottebergensis Krs., Küst., Conch. Cab., p. 17, pl. ii, f. 20–22. D.F.

1917. Pupa pottebergensis Krs., Küst., Pilsb., Manual, xxiv, p. 240, pl. xxxix, f. 8. D.F.

An exact miniature of typical capensis, which it resembles in all respects except, perhaps, for having slightly stronger, closer striae; the same spiral grooves are present on the later whorls.

The type appears to measure  $5\frac{1}{2} \times 2 \cdot 2$  mm., with 7 whorls, but if there is any point in preserving the varietal name the form is better represented by a pair from the Cuming collection in the British Museum from "Cape Colony," one of which is here figured; it contains 9 whorls and measures

Long. 5.0, lat. 2.6; last whorl 2.0 mm.

Hab. CAPE PROVINCE. Potteberg Mountain (Krauss); Port Elizabeth (Crawford, fide Pilsbry).

Type in Stuttgart Museum.

# Fauxulus ovularis (Küst.).

(Pl. xii, f. 8.)

Ref. List No. 357.

1841. *Pupa ovularis* Kurr, Küst., Conch. Cab., p. 10, pl. i, f. 16-18. *D.F*.

1842. Pupa kurrii Krs. (=ovularis Kurr, non Oliv.), Pfr., Symb., ii, p. 54. D.

1850. *Pupa kurrii* Krs. (=ovularis Kurr, non Oliv.), Küst., Conch. Cab., p. 111, pl. xv, f. 5-6. D.F.

1851. Pupa fonticola Desh., Hist. Moll., ii, p. 220, pl. clvi, f. 26-28. D.F.

1917. Fauxulus capensis ovularis Küst., Pilsb., Manual, xxiv, p. 238, pl. xxxix (1918), f. 5, 7. D.F.

1917. Pupa fonticola Desh., Pilsb., ibid., p. 239, pl. xxxix, f. 9. D.F.

Considerably larger than typical capensis, with comparatively more obese, ovate contour, never cylindriform; the coloration and normally 5-fold dentition agree with capensis, though there is a greater tendency for growth of small additional dental processes in this larger form. Several examples measured are

Long. 11.7, lat. 5.6; last whorl 5.2 mm., 10 whorls.

11.5 ,, 5.2 5.210 11.3 ,, 4.5 4.810 ,, 10.0 ,, 5.1 4.5 $9\frac{1}{4}$ ,, 4.9 9.5 ,, 4.5 $8\frac{1}{2}$  $4 \cdot 1$ 9.0 .,  $4 \cdot 1$ 

Hab. CAPE PROVINCE. Zoetandals Valley and Potteberg, Swellendam District (Krauss); Bredasdorp (Layard; Rennie); Cape of Good Hope (fonticola, Verreaux).

Type in Stuttgart Museum.

Pfeiffer renamed the species on the ground that it was preoccupied by *P. ovularis* Oliv., but Pilsbry rightly revived the appropriate name

of ovularis, since Olivier's species was described as a Bulimus and is actually a Chondrula, so does not affect Küster's nomenclature.

P. fonticola agrees in all respects with ovularis; the dark peripheral thread mentioned in Deshayes' description is of frequent occurrence in members of this sub-genus.

It is with greatest hesitation that I venture to restore ovularis to full specific status, but when a large series of capensis and itself are available for comparison the difference between them in size and contour is so notable that there would be no difficulty in separating them, were it not for the two series last mentioned in my notes on capensis. Typical ovularis has hitherto been a rare shell in collections, and until recently somewhat obscured by erroneous labels on tablets in the British Museum, which accounts for its having been relegated to varietal rank; but it will be seen from the tables of measurements that while capensis sometimes approaches very nearly the length of ovularis, its cylindrical form causes its width to be considerably less in proportion, while the shortest examples of ovularis are far wider than the longest capensis. It is to be hoped too on other grounds that this separation may be valid, since ovularis has page priority over capensis, which would have to become a variety of the former if held to be conspecific.

var. fortidentata nov. (Pl. xii, f. 3.)

Similar to type in all respects but for differing considerably in strength and number of basal and labral folds; the latter, situate just below the sinus, becomes a large square slab instead of a mere denticle, and the former, on left of base, is connected by a col with another large tooth far within the gullet; in 5 out of 8 examples examined there is an additional small denticle about midway between the foregoing; in 2, a still smaller one to its right, and in 5 yet another, somewhat entering, near the centre of the base. Three specimens measure  $9.5 \times 4.2$ ,  $9.3 \times 4.2$ , and  $8.8 \times 4.1$  mm.

Hab. CAPE PROVINCE. Bredasdorp (Layard; Rennie). Type in British Museum.

# $Fauxulus\ burnupianus\ {\bf Pilsb}.$

1928. Fauxulus burnupianus Pilsb., Nautilus, xli, p. 108. D. 1929. , , , Ann. Natal Mus., vi, p. 300,

pl. xx, f. 1–3. D.F.

1931. Fauxulus burnupianus Pilsb., Manual, xxviii, p. 73, pl. xiv, f. 1–3. D.F.

Similar in most respects to *capensis*, but differing in its larger teeth, the lower palatal being longer and the upper very long, entering deeply and curving downward at its inner end, while there is a very small additional double denticle on the labrum, between the larger two.

The type measures  $5.9 \times 2.8$  mm., with  $9\frac{1}{2}$  whorls, and another example  $7.1 \times 3.1$  mm.

Hab. CAPE PROVINCE. Seal Rock, opposite Dyer I. (Lang & Boulton).

Type in Academy of Natural Sciences, Philadelphia.

It is obvious that this species bears the same relation to capensis as does my var. fortidentata to ovularis, and if a general reunion is once more effected fortidentata will become a slightly exaggerated example of burnupianus, and the latter a variety of capensis with stronger dentition; I leave the matter here for the nonce for deliberation by malacologists of a future date.

# Section Fauxulella Pilsb., 1917 (Manual, xxiv, p. 235).

Shell highly sculptured, uniform brown, immature shells furnished with dental processes.

# Fauxulus pamphorodon (Bs.). Ref. List No. 361.

1864. Pupa pamphorodon Bs., A.M.N.H., xiii, p. 495. D.

1917. Fauxulus pamphorodon Bs., Pilsb., Manual, xxiv, p. 240, pl. xxxix (1918), f. 10–12. D.F.

Shell of fair size, sinistral, subcylindriform, rimate, fairly solid, silky, chocolate (or paler) brown. Spire produced, sides regular, summit, 5 whorls, conical. Whorls 10, nearly flat, last 3 nearly equal, first 2 practically smooth, remainder sculptured with strong, close, oblique, irregularly branching costulae, crossed on the later whorls by fairly close, regular, spiral grooves, visible under a hand-lens; suture simple, shallow. Aperture nearly square, rounded at base, peristome white and glossy, broadly expanded, dentition usually 8-fold; a strong, curved angular lamella, emerging to the lip edge, and an inrunning parietal one; a strong columellar lamella, pointing downward from the upper angle; 3 strong palatal plicae, the upper bilobed and largest, with a small tubercle between it and the plica below it, and a small sinular denticle above.

Long. 8·8, lat. 4·0; apert. alt. (extreme) 3·7, lat. 3·0; last whorl 4·0 mm.

Hab. CAPE PENINSULA. Simonstown (type, Layard); Kalk Bay; Slang Kop; Pauls Berg; Cape Point (Connolly).

CAPE PROVINCE. Hills behind Hermanus (Rennie).

Type in British Museum.

My smallest shell, from Cape Point, measures 7.2, with 9 whorls, and my largest, from Slang Kop, 10.7 mm. in length, with  $10\frac{1}{2}$  whorls.

The contrast between the dark chocolate spire and creamy aperture renders this a very handsome species. I agree with Benson in terming the 3 strong plicae between the base and top of the labrum palatal, but the lowest may be accepted as equivalent to the basal fold of Pilsbry's scheme; the small tubercle between the upper and lower palatal folds, though not mentioned in the original description, occurs in all specimens I have examined.

Immature shells are narrowly umbilicate, sharply carinate at the periphery, and the flat, colourless base is sculptured with strong, close, regular, spiral grooves. Just within the aperture on the base of the 5th whorl occur 2 strong plicae side by side, appearing square from the front and receding inwards, parallel to one another for a short distance, the outer being the longer, and both showing clearly as white lines through the base of the shell; I have examined half a dozen or more examples constant in these details, while another with 6 whorls shows the same 2 plicae just within the aperture, and their presence is also indicated by 2 white lines in the usual position half a whorl further in and again at the entrance of the 5th whorl. I have failed to find them persisting after breaking down mature shells to the same stage.

Sub-genus Tomigerella Pfr., 1879 (Nomenclator, p. 347).

Type  $Pupa\ soluta\ {\it Pfr.}\ (= layardi\ {\it Bs.}).$ 

Angular lamella and upper palatal plica emerge to the lip edge; spire slender above; peristome expanded and free.

Fauxulus layardi (Bs.). Ref. List No. 350.

1856.  $Pupa\ layardi$  Bs., A.M.N.H., xviii, p. 435. D.

1863. ,, soluta Pfr., P.Z.S., p. 525. D.

", ", ", " " Mon. Hel., vi, p. 315. *D*.

1917. Fauxulus layardi Bs. (= soluta Pfr.), Pilsb., Manual, xxiv, p. 243, pl. xli (1918), f. 4–6. D.F.

Shell dextral, of fair size, subturriform, rimate, thin, smooth, glossy, transparent, corneous brown. Spire produced, apical whorls slightly tapering, apex acute. Whorls 9, flattish, regularly increasing, first 2 practically smooth, remainder sculptured with weak, slightly curved, oblique striolae, crossed on the later whorls by fairly close, strong, regular, microscopic spiral grooves; suture simple. Aperture shortly tubular, nearly circular, peristome white, glossy, broadly expanded, continuous and free; dentition 7-fold; an inset parietal and an emergent angular

lamella; strong upper and lower palatal folds, the former emerging to the lip edge and both marked by white lines on the exterior; a low, thin basal fold; a horizontal columellar lamella and a small, deep-set denticle, often almost evanescent, in or near the upper angle of the columella.

Long. 9.2, lat. 3.3; apert. alt. 3.1, lat. 2.5; last whorl 3.7 mm.

My smallest shell from Cape Point is 8.5 mm. long.

Hab. CAPE PENINSULA. Cape Point (type, Layard; Connolly). CAPE PROVINCE. Hermanus (Lightfoot).

Originals of layardi in Cambridge Museum; soluta ubi?

The aperture sometimes shows small additional tubercles in irregular positions, but such are of only accidental occurrence. The only immature shell examined is extremely faintly, closely microspirally engraved on the nearly flat, colourless base, and just within the aperture of the 7th whorl are 2 small tubercles, one midway up the outer wall and the other on the left of the base; they do not appear to be accidental, but their status cannot be determined without further material.

### var. minor Bs.

### Ref. List No. 350.

1864. Pupa layardi, var. minor Bs., A.M.N.H., xiii, p. 496. D.

1917. Fauxulus layardi stoaphora "Bs.," Bnp. (=var. minor Bs.), Pilsb., Manual, xxiv, p. 245, pl. xli (1918), f. 7-8. D.F.

A smaller race, with same dentition as the type, but only 8 whorls, and measuring from 5.4 to 7 mm. in length and 2-3 mm. in breadth.

Hab. CAPE PROVINCE. Bredasdorp, at roots of grasses (type, Layard); Windhoek; Elim Road, 5 miles S.W. of Bredasdorp (Rennie). Originals of var. *minor* in Cambridge, *stoaphora* in British Museum.

# Fauxulus fryanus (Bs.).

(Pl. xii, f. 11.)

Ref. List No. 358.

1864. Pupa fryana Bs., A.M.N.H., xiii, p. 495. D.

1865. " fryali Bs., Mts., Zool. Record, i, p. 234. Err. Typ.

1917. Fauxulus fryanus Bs., Pilsb., Manual, xxiv, p. 246. D.

1931. Fauxulus fryanus Bs., Conn., A.M.N.H., viii, p. 308, pl. x, f. 11. D.F.

1934. Fauxulus fryanus Bs., Pilsb., Manual, xxviii, p. 121, pl. xxi, f. 14. N.F.

Shell sinistral, of fair size, torpediform, umbilicate, dull, somewhat silky, pale lilac, reddish towards the apex. Spire produced, sides nearly parallel, summit,

6½ whorls, conical. Whorls 12, flattish, slowly increasing, first 2 smooth, remainder sculptured with strong, close, regular, curved oblique costulae, crossed on the last 8 by strong, close, spiral grooves, visible under a weak lens; suture simple, well defined. Aperture shortly tubular, roughly triangular, canaliculate at base, peristome free, white and glossy, narrowly expanded, dentition normally 5-fold; strong inrunning parietal and angular lamellae, the latter emerging to the surface, former deep-set; a small sinular fold entering deeply from edge of labrum; a fold on the left centre of the base, sometimes so deep-set as to be invisible, and a strong, narrow, horizontal lamella deep-set half-way up the columella; from the canal at basal margin of aperture there coils a very strong, acute basal carina, encircling the umbilicus, which is round and comparatively wide, extending to the summit. The shell from Bredasdorp here figured measures

Long. 7.8, lat. 3.6; apert. alt. (extern.) 2.0, lat. 1.8; last whorl 3.2 mm.

Hab. CAPE PROVINCE. Bredasdorp (type, Fry; at roots of grasses among stones, Layard).

Type in British Museum.

The extraordinary strength of the circum-umbilical keel is alone enough to distinguish this remarkable species from any of its confrères.

Fauxulus pycnochilus sp. n. (Pl. xii, f. 10.)

Shell sinistral, very small, subcylindrical, narrowly umbilicate, semi-calcareous, silky, white with an occasional dark streak or dot. Spire produced, sides practically parallel, summit,  $5\frac{1}{2}$  whorls, an equilateral triangle. Whorls nearly 10, last 4 nearly equal, first  $1\frac{1}{2}$  smooth, remainder sculptured with slightly irregular, curved, oblique striae; suture shallow, simple. Aperture narrow oblong, rounded at base, peristome somewhat expanded, nearly free, labrum erect and nearly straight, with prominent sinus; dentition 6-fold; a very deep-set, far-entering parietal lamella; a strong, nearly vertical, deeply entering angular lamella, emerging to the surface; a superficial simular tubercle, with a strong deep-set plica corresponding to but not connected with it, far within the aperture; another, oblique and more deep-set within the centre of the base, and a round, rather obscure, deep-set process half-way up the columella; callus very strong, white, and continuous, umbilicus round and narrow.

Long.  $6\cdot 1$ , lat.  $2\cdot 6$ ; apert. alt. (extern.)  $1\cdot 9$ , lat.  $1\cdot 3$ ; last whorl  $2\cdot 8$  mm.

Hab. CAPE PROVINCE. Gorge of Salt River, Windhoek, Bredasdorp District (Rennie).

Type in Albany Museum.

A second example is a trifle shorter, 5.6 mm. in length.

The dentition resembles that of *fryanus*, but the lack of spiral sculpture and basal carination renders the new species abundantly distinct.

Sub-genus Anisoloma Ancey, 1901 (J. de C., xlix, p. 141). Type Pupa ponsonbyana Morel.

All or nearly all lamellae emerge to the lip edge.

# Fauxulus ponsonbyanus (Morel).

(Pl. xii, f. 6.)

Ref. List No. 363.

1889. Pupa (Faula) ponsonbyana Morel., J. de C., xxxvii, p. 9, pl. i, f. 5. D.F.

1917. Fauxulus ponsonbyanus Morel., Pilsb., Manual, xxiv, p. 253, pl. xl (1918), f. 7–9. D.F.

Shell small, sinistral, acuminate ovate, rimate, silky, pale corneous rufous brown. Spire produced, sides convex, apex submamillate. Whorls 8, convex, gradually increasing, first  $1\frac{1}{2}$  engraved with close, regular, microspiral lines, of which there are about 14 on the 2nd whorl, remainder sculptured with strong, close, regular, curved, slightly oblique costulae, continuing into the rima but developing at the periphery into short, strong, up-curved bristles, which are present in the sutures of well-preserved shells. Aperture quadrate, rounded at base, peristome slightly expanded, labrum straight and scarcely receding in profile, dentition 9-fold; a strong inrunning parietal and angular lamella, a short supra-palatal (sinular) and long inrunning upper and lower palatal folds, a similar basal fold, a short fold at the base of, and 2 long inrunning lamellae half-way up, and near the top of the columella respectively.

Long. 3·2, lat. 1·9; apert. alt. 1·0, lat. 0·9; last whorl 1·9 mm.; other dimensions given by Burnup range from 3·59 to 2·74 and 1·86 to 1·42 mm. in length and

breadth.

Hab. CAPE PROVINCE. Port Elizabeth (type, Crawford; Reeve); Somerset East (Miss Bowker); Grahamstown; Bathurst; Kowie (Farquhar); Alexandria District (Crawford); Pirie (Godfrey); East London (Kincaid); Riversdale; Keurbooms R. bush (Barnard); Great Fish R. (J. L. B. Smith).

NATAL. Hilton Road; Zwaart Kop, near Pietermaritzburg; Dargle; Port Shepstone (Burnup).

TRANSVAAL. Pepiti Falls, Sibasa (Harries).

Type in British Museum.

This species does not appear subject to much variation; it is always narrower than *glanvilleanus*, the smaller form of which it resembles in nearly all other particulars; the example described from Keurbooms R. bush is selected as showing to perfection the elusive sutural coronet of bristles, which is only present in freshest specimens.

# Fauxulus glanvilleanus (Ancey).

Ref. List No. 359.

1888. Pupa glanvilleana Ancey, Le Naturaliste, x, p. 200. D.
1911. ,, (Fauxulus) glanvilleana Ancey, var. tomlini Bnp.,
A.M.N.H., vii, p. 413, pl. x, f. 7. D.F.
vol. xxxiii.

1917. Fauxulus glanvilleanus Ancey, Pilsb., Manual, xxiv, p. 249. D.

1917. Fauxulus glanvilleanus novenarius Pilsb., ibid., p. 250, pl. xl (1918), f. 1–2. D.F.

1917. Fauxulus glanvilleanus tomlini B<br/>np., Pilsb., ibid., p. 252, pl. xl (1918), f. 8.  $\,$ <br/> $\,$   $\,$   $\,$   $\,$   $\,$   $\,$   $\,$  D.F.

Shell small, sinistral, asperate, corneous buff or bright brown. Spire produced, sides convex, apex blunt. Whorls  $8\frac{1}{2}$ , rather flat, gradually increasing, first  $1\frac{1}{2}$  smooth, remainder covered with close, strong, slightly curved and oblique transverse costulae, suture simple, well defined. Aperture quadrate, peristome white, glossy, expanded, dentition 9-fold, each process entering deeply though emerging to the surface; parietal and angular lamella, the latter at the upper end of the prominent sinus; 3 labral folds, the upper at lower end of sinus, of equal strength with the next, the lowest the strongest; a narrow fold at centre of base and 3 columellar lamellae, the lowest nearly horizontal and the 2 upper slanting steeply downwards.

Long. 4.0, lat. 2.0; apert. alt. 1.5, lat. 1.3; last whorl 2.1 mm.

Hab. CAPE PROVINCE. East London (type, Miss Glanville; Miss Bowker; tomlini, Radford); Gamtoos (Reeve); Albany District (tomlini, Miss Glanville); Keurbooms R. bush (Barnard); Grahamstown (Kincaid; novenarius, per Sowerby & Fulton); Somerset East (Mrs. Howard); Kowie (Langley); Port Alfred (Hewitt); Martindale (Farquhar); Knysna (J. L. B. Smith).

NATAL. Southport (Puzey); Bulwer (Warren); Krantzkop (Falcon).

Type lost; paratype, and type of tomlini in British Museum.

Layard's note on glanvilleanus runs, "A pretty little species, found about East London by Miss Glanville and Miss Bowker and named after the former," and the paratype described coincides with Ancey's measurements and agrees with his original description, except that the last omits to mention the basal process which occurs in all other observed examples. Burnup and Pilsbry have attached considerable importance to this fact, but an author like Ancey, who could describe Pisidium ovampicum without troubling to open the closed valves, would surely be capable of overlooking a tooth more or less in a little pupillid, especially if it were poorly developed or obscured by dirt, while it may, of course, have been actually lacking from his type. There appears to be no question as to what Pupa glanvilleana really is; it was distributed by Miss Bowker to Layard and by Miss Glanville to Tomlin, and Burnup's var. tomlini can only represent the typical form of Ancey's species, and must fall into its synonymy.

Two examples of F. g. novenarius Pilsb. are said to measure

 $3.9 \times 2.1$  (8 whorls) and  $4.1 \times 2.0$  mm. with  $8\frac{1}{4}$  whorls, and the figure shows it to be inseparable from the foregoing; Pilsbry's differentiation is easily understandable, since the specimen from Somerset East, received from Burnup as tomlini and figured as such in the Manual, might well be considered almost varietally distinct. That race, however, does not agree with Burnup's type, being relatively more slender, with sinus less developed, basal fold narrower, and the 2 upper lamellae on the columella weaker and rather less oblique; this race is now left without a varietal name, but it is inadvisable to give it one, as the series from Keurbooms R. bush includes intermediates between it and the type, so it probably represents merely individual variation.

Reeve's largest shell from Gamtoos, with 9 whorls, measures  $5.6 \times 2.6$  mm., and some of the series from this locality and Southport retain sufficient crop of sutural bristles to prove that *glanvilleanus* is normally spiniferous, like *ponsonbyanus*, as might be expected from the close relation of the two species.

An immature shell from Knysna, with  $5\frac{1}{2}$  whorls, shows no sign of internal dentition.

# var. darglensis Bnp. Ref. List No. 359.

1908. Pupa (Fauxulus) glanvilleana Ancey, M. & P., A.M.N.H., i, pl. ii, f. 23. F.

1911. Pupa (Fauxulus) glanvilleana Ancey, var. darglensis Bnp., A.M.N.H., vii, p. 412. D.

1917. Fauxulus glanvilleanus darglensis Bnp., Pilsb., Manual, xxiv, p. 250, pl. xl (1918), f. 6. D.F.

Differs from type in possessing an additional process, a small fold on right centre of base, and occasionally a third small upper labral fold just below the other two, which are placed closer together in order to give it room. The type measures  $3\cdot77\times2\cdot13$  mm. and the colour of known examples is corneous grey.

Hab. NATAL. Dargle; Game Pass, near Giant's Castle; Inhluzani Mountain; Karkloof; Ntimbankulu (Burnup); Balgowan (Pennington); Hilton (Falcon).

Type in British Museum.

Fauxulus pereximius (M. & P.). (Pl. xii, f. 9.) Ref. List No. 362.

1897. Pupa (Faula) pereximia M. & P., A.M.N.H., xix, p. 638, pl. xvii, f. 3. D.F.

1917. Fauxulus pereximius M. & P., Pilsb., Manual, xxiv, p. 247, pl. xl (1918), f. 3. D.F.

Shell sinistral, of average size, rimate, subrhomboid, silky, normally bright brown. Spire conical, apex, 2 whorls, produced and broader than the succeeding whorl. Whorls 9½, nearly flat, post-apical increasing regularly until the last, which narrows below the periphery and is strongly carinate around the rima, first in extremely fresh condition engraved with very close, faint microspiral lines, remainder bearing close, regular, curved transverse costulae, increasing gradually in distance apart and forming a cord-like fringe above the sutures of the later whorls and around the periphery; suture simple, almost linear. Aperture quadrate, angulate at base, peristome slightly expanded, labrum straight and vertical in profile, with a strongly marked sinus, dentition 9-fold; a strong, nearly vertical, incurved parietal lamella; a smaller angular lamella on the right of the sinus and a moderate supra-palatal fold some way below it; a strong, uprunning, upper palatal fold; a small lower palatal tubercle; a fold of medium size on left of base; another, similar, at base of columella; a strong horizontal lamella half-way up, and another, slanting somewhat downwards, near top of columella; columella oblique, callus thin.

Long. (type) 5.8, lat. 2.8; apert. alt. 1.7, lat. 1.5; last whorl 2.8 mm.

Hab. CAPE PROVINCE. Buffalo River (type, fide M. & P.); Port St. John's (Puzey).

Type in British Museum.

The sculpture is very similar to that of glanvilleanus, and the 9 dental processes occur in the same positions but differ considerably in size and strength, while the shell is larger and more obese in comparison than Ancey's species.

# Fauxulus falconianus Pilsb.

1929. Fauxulus falconianus Pilsb., Ann. Natal Mus., vi, p. 299, pl. xx, f. 4. D.F.

1931. Fauxulus falconianus Pilsb., Manual, xxviii, p. 75, pl. xiv, f. 4. D.F.

Resembles the foregoing but is much smaller. The number of teeth is the same, but the mid-columellar process slopes downward instead of being horizontal and the basal denticle is moved to the left, almost touching the lower labral. The type, with 9 whorls, measures  $4\cdot 4\times 2\cdot 6$  and a paratype  $4\cdot 5\times 2\cdot 6$  mm., while two of three specimens in my collection are 5 mm. in length.

Hab. NATAL. Zimbabe Bush, Krantzkop (Falcon).

Type in Academy of Natural Sciences, Philadelphia.

These two species stand apart from their confrères in the sudden tapering of the upper part of the spire.

### Fauxulus mcbeanianus M. & P.

Ref. List No. 360.

1901. Fauxulus (Anisoloma) mcbeanianus M. & P., A.M.N.H., viii, p. 319, pl. ii, f. 9. D.F.

1917. Fauxulus mebeanianus M. & P., Pilsb., Manual, xxiv, p. 247, pl. xl (1918), f. 4–5. D.F.

Shell sinistral, acuminate ovate, rimate, smaller and comparatively shorter in the spire than *pereximius*, colour varying from grey to brown. 8 moderately convex whorls, sculptured as in *pereximius*, aperture trigonal, rounded at base, peristome moderately expanded, dentition 8- or 9-fold, each process emerging to the surface; parietal and angular lamellae of about equal strength; 2 inrunning lamellae at the top of and half-way down the columella; a narrow inrunning fold near the centre of the base; another, far stronger, above it; a superficial tubercle just below, and either 1 or 2 just above the sinular angle. The shell described, from Karkloof, measures

Long. 4.3, lat. 2.6; apert. alt. 1.25, lat. 1.2; last whorl 2.2 mm.

Hab. NATAL. Karkloof Bush (type, McBean; Burnup); Majuba (Connolly); Balgowan (Pennington); Dargle; Nottingham Road; Van Reenen (Burnup); Bulwer (Warren); Kathkin; Hilton; Mont aux Sources (Falcon).

Type in British Museum.

An immature shell from Majuba with 7 whorls exhibits on the base of the last, a short distance from the labrum, 2 strong septa, parallel to the aperture and extending across the whorl; as the shell continued its growth they would therefore be found pendent from the upper side of the completed whorl, instead of on the base, the usual position in which juvenile armature in this genus occurs; the processes appear quite normal, but lack of sufficient material deters me from breaking down mature examples to ascertain if they become absorbed with increasing growth.

### Fauxulus barnardi Conn.

(Pl. xii, f. 5.)

1931. Fauxulus barnardi Conn., A.M.N.H., viii, p. 309, pl. x, f. 5. D.F.

1934. Fauxulus barnardi Conn., Pilsb., Manual, xxviii, p. 121, pl. xxi, f. 4. D.F.

The small, sinistral, subfusiform shell is reddish brown, with similar, but rather finer transverse sculpture than that present in most of the subgenus. 8 whorls, not very convex; aperture subquadrate, peristome just free, expanded and continuous, dentition 7-fold; a strong, slightly incurved, inrunning parietal lamella, arising in centre of paries; a similar angular lamella arising on edge of labrum; 2 blunt denticles, the lower slightly larger, close together half-way down the labrum; a strong inrunning lower palatal fold; a small tubercle about the centre of the base and a very prominent, descending, inrunning columellar lamella.

Long. 4.7, lat. 2.6; apert. alt. 1.7, lat. 1.7; last whorl 2.2 mm.

Hab. CAPE PROVINCE. Keurbooms River bush (Barnard).

Type in South African Museum.

Distinct from other members of the subgenus in having but a single process on the columella, whereas the others have 2 or more.

# $Fauxulus\ crawfordianus\ {\bf M.\ \&\ P.}$

### Ref. List No. 341.

1903. Fauxulus crawfordianus M. & P., A.M.N.H., xii, p. 605, pl. xxxi, f. 6. D.F.

1911. Pupa crawfordiana M. & P., Bnp., A.M.N.H., vii, p. 402, pl. x, f. 1–2. N.F.

1917. Fauxulus crawfordianus M. & P., Pilsb., Manual, xxiv, p. 242, pl. xli (1918), f. 1–2. D.F.

Shell dextral, of fair size, acuminate, rimate, smooth, moderately glossy, transparent, corneous brown, interior and dentition in fresh shells pale fawn. Whorls  $8\frac{1}{2}$ , flattish, regularly increasing, first  $2\frac{1}{2}$  smooth, remainder bearing rather distant, extremely weak, oblique striolae; suture simple, well defined. Aperture subquadrate, rounded at base, peristome white, glossy, somewhat expanded, labrum vertical in profile, dentition 6-fold; a mid-parietal and an angular lamella, the latter extending inwards from outer edge of labrum; a fold on labrum, sloping downwards and inwards; a curved fold entering from centre of base; a curved, entering lamella at top of columella and a rather deeply inset tubercle on left of base; columella erect, margin not expanded more than rest of peristome, callus thin, continuous.

Long. (type) 8.0, lat. 3.6; apert. alt. (extreme) 2.75, lat. 2.3; last whorl 3.4 mm.

Hab. CAPE PROVINCE. Mossel Bay (type, Crawford); hills behind Hermanus (Rennie; Lawrence).

Type in British Museum.

# Subfamily PUPILLINAE.

Animal oviparous or viviparous, with two pairs of tentacles; penis bifid, with long appendix and forked retractor, spermathecal duct often with diverticulum. Jaw of very narrow concrescent plates: radula with central tricuspid, laterals bicuspid, marginals with numerous narrow cusps. Shell, except in *Lauria*, without apertural

armature until adult, when there are from 0 to 5 teeth in the normal positions; angular lamella not entering; basal wanting.

Genus Pupilla Fleming, 1828 (Brit. Animals, p. 268). Type Turbo muscorum L.

Features as in subfamily, except Lauria.

Section Gibbulinopsis Germ., 1919 (Bull. Mus. Paris, xxv, p. 265). Type Pupa pupula Desh. (=Primipupilla Pilsb., 1921).

Shell cylindrical.

,,

Pupilla fontana (Küst.). (Pl. xii, f. 13.) Ref. List No. 347.

1841. *Pupa fontana* Krs., Küst., Conch. Cab., p. 122, pl. xvi, f. 9-12. *D.F*.

\* 1874. Pupa fontana Krs., var. globulosa Jick., Fauna N.-O.-Afr., p. 121, pl. v, f. 11. D.F.

1883. Pupa raffrayi Bgt., Ann. Sci. Nat., xv, p. 71. D.

1892. ,, elizabethensis M. & P., A.M.N.H., ix, p. 91, pl. v, f. 13. D.F.

1894. Pupa charybdica M. & P., A.M.N.H., xiv, p. 94, pl. i, f. 13. D.F.

1894. Pupa custodita M. & P., ibid., p. 93, pl. i, f. 9. D.F.

,, ,, frustillum M. & P., ibid., p. 94, pl. i, f. 14. D.F.

,, keraea M. & P., ibid., p. 94, pl. i, f. 12. D.F.

1896. ,, amphodon M. & P., A.M.N.H., xviii, p. 317, pl. xvi, f. 6–7. D.F.

1901. Pupa endoplax M. & P., A.M.N.H., viii, p. 319, pl. ii, f. 10. D.F.

1908. Pupa fontana Krs. (=elizabethensis, charybdica, custodita, frustillum, keraea, omicronaria, amphodon, and endoplax) M. & P., A.M.N.H., i, p. 74. N.

1911. Ennea iredalei Prest., Rev. Zool. Afr., i, p. 218, pl. xi, f. 5. D.F.

1921. Pupilla (Primipupilla) fontana Krs. (=raffrayi Bgt. and globulosa Jick.), Pilsb., Manual, xxvi, p. 207, pl. xvi, f. 1–23. D.F.

1922. Pupilla fontana Krs. (= Ennea iredalei Prest.), Conn., A.M.N.H., x, p. 497. N.

1927. Pupilla fontana Krs., Pilsb., Manual, xxvii, p. 255. N. 1930. , , , , Conn., Ann. S.A. Mus., xxix, p. 292. N.

Shell very small, cylindriform, narrowly umbilicate, smooth, glossy, transparent, corneous brown. Spire moderately produced, sides scarcely convex, apex rounded. Whorls 6, convex, last 3 subequal, first 2 smoothly malleate, remainder sculptured with extremely weak, straight, oblique striolae; suture simple, well defined. Aperture quadrate, peristome white, slightly expanded, labrum straight and nearly vertical in profile, dental processes normally 4, all somewhat inset; a strong parietal lamella; a small blunt denticle half-way down the labrum, usually with a small external pit, and a stronger one on right centre of base, each of which is occasionally developed into a more or less deeply entering fold, and a high situate columellar lamella; columella short, inclined to the left, margin triangularly reflexed over the very narrow umbilicus.

The Port Elizabeth specimen described and figured owing to its showing plainly all 4 teeth, measures

Long. 3.0, lat. 1.5; last whorl 1.5 mm.

The palatal teeth show white through the shell; young shells are bluntly angulate at periphery with somewhat flattened base, but I have not observed in them apertural dentition. I suggested in my Reference List that *elizabethensis* might deserve varietal retention as an albino form, but the type set and all other white examples that I have yet seen are merely that colour on account of bleaching; the varietal name need not therefore be retained.

Hab. TRANSVAAL. Source of Mooi River (type, Wahlberg); rather widely distributed, custodita, keraea, and omicronaria being described from the Pretoria District.

ORANGE FREE STATE. Bloemfontein; Rustfontein(Connolly). NATAL. Karkloof (McBean); Balgowan (Pennington); Edendale; Tongaat (Burnup).

ZULULAND. Mfongosi (Jones).

CAPE PROVINCE. Somewhat widely distributed; endoplax was described from Cradock, and amphodon, charybdica, frustillum, and elizabethensis from Port Elizabeth.

GRIQUALAND WEST. Kimberley (Miss Wilman); Blaauwbosch, Hay District (Day).

BECHUANALAND. Tlapings Laagte Well, west of Vryburg, and Hope Vlei, near Vryburg (subfossil, Rogers).

DAMARALAND. Gobabis (subfossil, Hermann).

GREAT NAMAQUALAND. Aiais (Hesse & Thorne).

Type of fontana in Stuttgart, and all South African synonyms in British Museum.

Although not yet recorded from the western and south-tropical regions of Central Africa, this species, which is far less variable than its synonymy suggests, appears to extend to Kenya (*iredalei*) and Abyssinia (*raffrayi* and *globulosa*).

Section Afripupilla Pilsb., 1921 (Manual, xxvi, p. 153).

Type Pupa tetrodus Bttg.

Shell tapering upwards, somewhat like Gastrocopta.

Pupilla tetrodus (O. Bttg.). Ref. List No. 356.

1870. Pupa tetrodus Bttg., Ber. Offenbach. Ver. f. Naturk., xi, p. 46, pl. i, f. 1. D.F.

1880. Pupa (Vertigo) sinistrorsa Crvn., P.Z.S., p. 618, pl. lvii, f. 8. D.F.

1891. Pupa (Vertigo) thaumasta M. & P., A.M.N.H., viii, p. 239. D.

1921. Pupilla (Afripupilla) tetrodus Bttg., Pilsb., Manual, xxvi, p. 216, pl. xvii, f. 9–10, 14–16. D.F.

1930. Pupilla tetrodus Bttg., Conn., Ann. S.A. Mus., xxix, p. 293. L.

Shell very small, sinistral, acuminate ovate, rimate, silky, otherwise like fontana. Whorls 5, very convex, regularly increasing, the sculpture on the last 3 being rather stronger than in fontana, aperture and dentition agreeing with that species, there being a mid-parietal fold and teeth on centres of labrum, base, and columella, the two former showing white on the exterior of shell, without external pitting. The example from Pretoria, described, measures

Long. 3.0, lat. 1.3, last whorl 1.7 mm., while a large Zulu shell is 3.5 mm. in length.

Hab. BECHUANALAND. Gokwe River, about 30 miles north of Palapwe Road (type, subfossil, Hubner).

BRITISH BECHUANALAND. Hartz River, Taungs (Miss Wilman).

GRIQUALAND WEST. Newlands (M. L. Paton); Postmasburg (Power); Kimberley (Miss Wilman).

OVAMBOLAND. Disappointment Vlei (Andersson & Chapman, fide Layard).

DAMARALAND. Outjo; Narebis; Nuragas; Usakos (Barnard). KAOKOVELD. Ombombo; Kaoko Otavi; subfossil at Kamanyab (Barnard).

GREAT NAMAQUALAND. Aiais (Hesse & Thorne).

CAPE PROVINCE. Cape Récif; Klein Setjes Bosch, near Beaufort (sinistrorsa, Craven); Port Elizabeth (thaumasta, Crawford); distributed throughout most of the province.

TRANSVAAL. Pretoria (Connolly); Potchefstroom (Miss Livingston).

ORANGE FREE STATE. Bloemfontein (Godfrey); Kroonstad (Miss Hickey).

ZULULAND. Mfongosi (Jones).

I have seen this species from N. Rhodesia, collected on the north bank of the Zambesi at the Victoria Falls, but not yet from the south bank.

Type of *tetrodus* in Senckenberg, *sinistrorsa* and *thaumasta* in British Museum.

Genus *Pupoides* Pfr., 1854 (Mal. Blätt., i, p. 192).

Type  $Bulimus\ nitidulus\ Pfr.$ 

(=Leucochila Mts., 1860, and Leucochiloides Pfr., 1881).

As Pupoides Fér. cited in my Reference List has been ruled to be a French plural rather than a classical singular noun, Pfeiffer's appropriate name of 1854 takes precedence for this genus of small shells, usually with slightly tapering spire and aperture toothless, except for a small superficial tubercle, rarely wanting, close to or united with the labrum at its junction with the paries; peristome expanded and reflexed.

The proper nomenclature of the South African representatives of the genus is a matter of grave uncertainty, owing to their extremely close affinity with the Indian P. coenopictus (Hutton), which appears to be established under various names in many parts of central and east Africa, and has been recorded by Pilsbry from Jansenville, C.P. On the other hand that eminent authority separates calabaricus and minusculus, described from south-west Africa, from Hutton's species, and the former of these appears to me inseparable from the Jansenville race; moreover, its distribution, originally supposed to be confined to the desert regions of the Kalahari, is now proved to extend right across the subcontinent into Zululand. Whether this may be due to an invasion from the east of the Indian coenopictus or a migration eastward of the Kalaharian race can only be ascertained when the anatomy of this genus is fully known, but it may be preferable meanwhile to retain for the whole of the forms that inhabit South Africa

the names originally bestowed on them, with the proviso that some, at least, may yield precedence to the older coenopictus after anatomical investigation.

# Pupoides calaharicus (O. Bttg.).

Ref. List No. 335.

1886. Buliminus (Leucochiloides) calaharicus Bttg., Ber. Senckenb. Ges., p. 24, pl. ii, f. 3. D.F.

1916. Leucochiloides calaharicus Bttg., Conn., Ann. S.A. Mus., xiii, p. 188. N.

1921. Pupoides calaharicus Bttg., Pilsb., Manual, xxvi, p. 138, pl. xiv, f. 10–11; pl. xvii, f. 8. D.F.

1922. Leucochiloides calaharicus Bttg., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 138. N.

1930. Pupoides calaharicus B<br/>ttg., Conn., Ann. S.A. Mus., xxix, p. 291.  $\,N.$ 

Shell small, elongate acuminate ovate, rimate, thin, smooth, rather dull, dark or bright corneous brown. Spire produced, sides straight or slightly convex, apex rounded. Whorls 5, convex, gradually increasing, 1st smooth and glossy, remainder sculptured with low, weak, slightly curved and oblique growth striae; suture well defined. Aperture oblong, rounded at base, peristome white, expanded and reflexed, ends rather distant, labrum straight and receding little in profile, columella erect, margin broadly reflexed over the strong rima; dentition confined to a short superficial tubercle, varying in strength, on the right of paries, very close and parallel, but not united, to the top of labrum. The Outjo shell on which this diagnosis is based measures

Alt. 5.9, lat. 2.5; apert. alt. 2.2, lat. (intern.) 1.1; last whorl 3.5 mm., but the species varies commonly in length from about 4.3 to 6 mm.

Hab. BECHUANALAND. Ghous (type, Nolte); Aries; Noap Hills; Reimvastmak, Molopo R.; Keimoes; Bak R. (Barnard); Hartz R., Taungs (Miss Wilman).

BRITISH BECHUANALAND. Maun, Ngamiland (Hale Carpenter).

GRIQUALAND WEST. Blaauwbosch Poort, Hay District (Day); Kimberley (Swan); Postmasburg (Power).

DAMARALAND. Karibib; Usakos (Frames); Outjo (Lawrence); Nuragas (Lightfoot); Namutoni; Narebis (Barnard).

GREAT NAMAQUALAND. Nakob (Barnard); Bullspoort (Tucker); Kuibis (Michaelsen); Homeib R., near Klip (Siegmann).

NAMIB. Swakopmund (K. Schmierer).

CAPE PROVINCE. Jansenville (Farquhar); Prieska (Gibbons); Karoo (in British Museum).

S. RHODESIA. Victoria Falls (Connolly).

TRANSVAAL. Pietersburg District (Ziervogel). ZULULAND. Mfongosi (Jones).

Type in Senckenberg Museum.

Böttger claims for his species that it is the most cylindrical of all known to him, longer and more cylindrical than "conspectus" (? coenopictus) Hutt., and its whorls increase so slowly that the three penultimate are little different in height. But the contour differs considerably in shells of the same series, and I cannot truly point out any constant feature by which calaharicus can be distinguished from the Indian form.

The series from Aries contains more than one remarkably large example, the largest, with 7 whorls, measuring alt. 6.8, lat. 2.9, last whorl 3.3 mm., but the aperture, alt. 1.35 mm., does not increase in proportion, proving that the abnormal length of the shell is solely due to the presence of the additional whorl.

The contour of this species is somewhat influenced by the relative convexity of the whorls, which are sometimes more convex about half-way down the spire, and consequently protrude further than the rest, giving the sides a slightly convex appearance; this feature is perhaps not quite so frequent in the western as in the eastern races in South Africa, but is found to some extent in long series from nearly all localities.

# Pupoides minusculus (Mouss.). Ref. List No. 336.

1887. Buliminus (Leucochiloides) minusculus Mouss., J. de C., xxxv, p. 295, pl. xii, f. 5. D.F.

1921. Pupoides minusculus Mouss., Pilsb., Manual, xxvi, p. 139, pl. xiv, f. 5. D.F.

1922. Leucochiloides minusculus Mouss., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 31. N.

1930. Pupoides minusculus Mouss., Conn., Ann. S.A. Mus., xxix, p. 290. N.

May possibly differ from the foregoing in smaller size and comparatively more obese contour. The type, if correctly measured, is unusually small, 5 whorls,  $3\times 1\cdot 8$  mm., the average size of specimens seen by myself being  $3\cdot 6\times 2$  mm. This small form appears to be restricted in recent condition to the northern districts of South West Africa, not having occurred south of lat. 19°.

Hab. OVAMBOLAND. Ku-Ganab, S.E. of Ondonga (type, Schinz); Hoeis (Hermann); Sodanna (Passarge); Onolongo; Ukualuthi (Barnard).

DAMARALAND. Sandup, N.W. of Tsumeb (Barnard). BECHUANALAND. Meno a kwena (subfossil, Passarge). Type in Zurich Museum.

#### var. major Dgnr.

1922. Leucochiloides minusculus Mouss., var. major Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 31. D.

1926. Pupoides minusculus Mouss., var. major Dgnr., Pilsb., Manual, xxvii, p. 252. N.

1930. Pupoides minusculus Mouss., var. major Dgnr., Conn., Ann. S.A. Mus., xxix, p. 291. N.

According to Degner, minusculus and its var. major can be distinguished from calaharicus through having flatter whorls, shallower suture and comparatively longer aperture,  $\frac{2}{3}$ ths of total length instead of barely  $\frac{1}{3}$ rd. His variety, however, although its contour may be typically rather more obesely ovate than that of calaharicus, appears to be connected with it by intermediates, and I doubt if any constant difference exists between them. Two paratypes with 5 fairly convex whorls measure

Alt. 5·6, lat. 2·8; apert. alt. 2·2; last whorl 3·2 mm., and ,, 5·3 ,,  $2\cdot4$  ,,  $2\cdot2$  ,,  $3\cdot0$  ,,

Hab. DAMARALAND. Tsumeb; Grootfontein; Otavifontein; Okahandja; Karibib; Okapuka (Michaelsen); Outjo; Usakos; Cauas Okawa (Barnard).

KAOKOVELD. Kaoko Otavi (Barnard).

Type in Hamburg Museum.

#### Pupoides bryantwalkeri Pilsb.

1926. *Pupoides bryantwalkeri* Pilsb., Manual, xxvii, p. 251, pl. xxxi, f. 12. D.F.

"Shell very slender, with  $6\frac{1}{2}$  convex whorls, the median more so than the terminals.

Alt. 4.55, diam. above aperture 1.4, max. 1.6; apert. alt. 1.35 mm."

Hab. SOUTH AFRICA, probably Port Elizabeth District (Crawford).

Type in Bryant Walker collection.

"The very slender contour of this form apparently indicates specific distinction; otherwise it is closely related to the widespread *P. coenopictus*."

It is not stated whether more than a single specimen of this form occurred, but if a singleton it may well be an abnormality; I can match it fairly well with a singleton in my own collection, from an

unknown locality, with  $6\frac{1}{4}$  whorls,  $4.9 \times 1.8$ , last whorl 2.3 mm., which I would hesitate to consider other than an outsize example of coenopictus.

Genus Microstele O. Bttg., 1886 (Ber. Senckenb. Ges., p. 26). Type Pupa noltei Bttg.

Very small turriform shells with obtuse apex, small angular tubercle, deeply placed parietal and columellar lamellae, and sometimes one or more immersed palatal tubercles.

Microstele noltei O. Bttg. (Pl. xii, f. 2.) Ref. List Nos. 337, 338.

1886. Pupa (Microstele) noltei Bttg., Ber. Senckenb. Ges., p. 25, pl. ii, f. 4. D.F.

1910. Leucochiloides (Microstele) oblongus B<br/>ttg., Abh. Senckenb. Ges., xxxii, p. 445, pl. xxviii, f. 11. D.F.

1921. Microstele noltei Bttg., Pilsb., Manual, xxvi, p. 150, pl. xiv, f. 12-16. D.F.

1921. Microstele oblongus Bttg., Pilsb., ibid., p. 149, pl. xiv, f. 17. D.F.

1922. Leucochiloides (Microstele) noltei (=oblongus) Bttg., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 33. D.F.

1926. *Microstele noltei* Bttg., Pilsb., Manual, xxvii, p. 253. *N*. 1930. ,, ,, ,, Conn., Ann. S.A. Mus., xxix, p. 292. *N*.

Shell very small, rimate, narrow turriform, rather dull, smooth, semi-transparent, corneous brown. Spire produced, sides scarcely convex, apex rounded. Whorls 5–7, usually little convex, slowly increasing, 1st smooth and glossy, remainder sculptured with rather coarse, fairly distant and regular, curved oblique growth striae; suture well defined. Aperture suboval, peristome white, expanded and reflexed, ends usually rather distant, labrum straight and receding little in profile, dentition normally 5-fold; a small angular tubercle, similar to that of Pupoides; a narrow, straight, somewhat deep-set midparietal fold; another, horizontal, half-way up the columella, and 2 small tubercles on the inner wall or palate, deeply immersed within the aperture: columella erect, margin reflexed over the narrow rima; the shell figured, from Sesfontein, is  $4\cdot0\times1\cdot5$ , last whorl 2 mm., but the species varies in length from  $3\cdot8$  to  $4\cdot5$  mm.

Hab. BECHUANALAND. Ghous (noltei, Nolte); Aries; Noap Hills (Barnard).

GREAT NAMAQUALAND. Homeib R., near Klip (Siegmann). DAMARALAND. 140 km. from Swakopmund (oblongus,

Rintelen); Omaruru (Michaelsen); Outjo; Usakos; Cauas Okawa (Barnard).

KAOKOVELD. Sesfontein (Lawrence).

Type in Senckenberg Museum.

Genus Lauria Gray, 1840 (Turton's Manual, p. 193). Type Pupa umbilicata Drap.

Shell small, perforate, ovate or cylindriform, with usually a deeply penetrating angular lamella, sometimes other teeth, and the immature (neanic) stage with lamellae on the parietal wall and short radial plicae at various intervals within the basal margin.

Animal with 2 pairs of tentacles.

Lauria dadion (Bs.). Ref. List No. 343.

1864. Pupa dadion Bs., A.M.N.H., xiii, p. 495. D.

1922. Lauria dadion Bs., Conn., Proc. Mal. Soc., xv, p. 76. N.

,, ,, ,, ,, Pilsb., Manual, xxvii, p. 64, pl. viii (1923), f. 3-6, D.F.; p. 259, N.

Shell very small, elongate ovate or subcylindriform, umbilicate, thin, smooth, glossy, transparent, corneous brown. Spire produced, sides slightly convex, summit rounded. Whorls 6, convex, regularly increasing, first 2 smooth, remainder sculptured with extremely faint, close, straight, slightly oblique microscopic striolae; suture impressed. Aperture subquadrate, rounded at base, peristome white, glossy, slightly expanded, with a shortly entering lamella on the paries, not quite connecting with the labrum; columella erect, margin triangularly reflexed, umbilicus very narrow, extending to the apex.

Long. 3·3, lat. 1·9; apert. alt. 1·2, lat. 1·2; last whorl 2·0 mm.

Hab. CAPE PENINSULA. Simonstown (type); ravine near Newlands (Layard).

CAPE PROVINCE. Bedford (Farquhar); Swellendam Mountains (Lawrence & Hesse).

NATAL. Umvoti County (Lightfoot); Karkloof; Nottingham Road; Inhluzani Mountain; Game Pass; Van Reenen (Burnup); Balgowan (Pennington).

TRANSVAAL. Manotsuri Mountain, Shiluwane District, 4000 feet (Junod).

ZULULAND. Mfongosi (Jones).

Type in British Museum.

There is frequently an almost imperceptible, bluntly pointed swelling about half-way up and rather deep-set on the columella, which is represented on the exterior by a thin, faint white line in the umbilicus; in the single shell from the Transvaal this swelling is unusually prominent and seems to be represented by a clear furrow, rather than line, in the umbilicus. Pilsbry describes a young example from Karkloof as having a strong columellar and angular lamella and 3 basi-palatal folds, while in a fully formed embryo of  $1\frac{1}{2}$  whorls there is only a short angular lamella. All these processes are usually absorbed as the shell increases in size.

# Lauria tabularis (M. & P.).

Ref. List No. 355.

1879. Pupa umbilicata Drap., Gibb., J. of C., ii, p. 282. L.

1893. ,, tabularis M. & P., A.M.N.H., xi, p. 20, pl. iii, f. 3. D.F. 1922. Lauria tabularis M. & P., Pilsb., Manual, xxvii, p. 65,

pl. viii (1923), f. 11-15. D.F.

A stouter shell than dadion, with which it agrees in number of whorls and all superficial details, except that the peristome is more broadly reflexed, the angular lamella lower and much shorter and connects with the labrum, and there is no white line in the umbilicus; the columella makes with the base a distinct angle, as in cylindracea, rather than a curve.

My shortest shell, with 5 whorls, is 3.1 mm. long, and the largest, with 6 whorls,

Long. 3.6, lat. 2.1; apert. alt. 1.3, lat. 1.3; last whorl 2.1 mm.

Hab. CAPE PENINSULA. Cape Town (type, Lightfoot); Rondebosch (Connolly); abundant in garden hedges about Cape Town (umbilicata, Gibbons).

Type in British Museum.

Pilsbry attributes Gibbons' record to dadion, but that is a rustic species, seldom, if ever, found near cultivation, whereas tabularis is a garden dweller, so nearly resembling umbilicata (cylindracea Da Costa) that it may well be identical with that species.

Pilsbry mentions an immature shell of nearly 5 whorls with a low lamella on the parietal whorl, a minute, deeply immersed columellar, and 2 minute tubercular basal folds, situate as in *dadion*, but much smaller; he adds that the species is certainly very similar to *cylindracea*, but may differ in having a shorter angular lamella and the teeth in immature examples being smaller than in the European species.

#### Lauria farquhari (M. & P.). Ref. List No. 346.

1898. Pupa farquhari M. & P., A.M.N.H., ii, p. 128, pl. vii, f. 7. D.F.

1922. Lauria farquhari M. & P., Pilsb., Manual, xxvii, p. 63, pl. viii (1923), f. 1-2. D.F.

Shell comparatively large, subcylindriform, umbilicate, thin, smooth, glossy, transparent, corneous brown. Spire produced, sides scarcely convex, apex rounded. Whorls 7, not very convex, slowly increasing, first 3 smooth, remainder sculptured with very weak, straight, oblique striolae, strongest just below the well-defined suture. Aperture quadrate, rounded at base, peristome expanded, dentition limited to a strong, inrunning angular lamella, columella straight, erect, margin broadly triangularly reflexed, umbilicus narrow, but deep. A topotype in my collection measures

Long. 4.0, lat. 2.1; apert. alt. 1.6, lat. 1.0; last whorl 2.25 mm.

Hab. CAPE PROVINCE. Elandsberg Mountain, Cradock (type, Farguhar); Riversdale (Barnard).

Type in British Museum.

The bulkiest South African member of the genus, though not quite attaining the length of L. longa described hereafter; the Riversdale race is shorter, with 6 whorls, measuring  $3.6 \times 2.0$  mm.

#### Lauria cryptoplax (M. & P.). Ref. List No. 342.

1899. Pupa cryptoplax M. & P., A.M.N.H., iv, p. 198, pl. iii, f. 11. D.F.

1922. Lauria cryptoplax M. & P., Pilsb., Manual, xxvii, p. 65, pl. viii (1923), f. 7–10. D.F.

More tapering than the foregoing, with 7 flatter whorls and weaker sculpture. The aperture is comparatively longer and narrower, peristome white, rather broadly reflexed, dentition 2-fold; a strong, deeply entering angular lamella and low, narrow, thread-like, but very deeply entering lamella half-way up the columella; umbilicus comparatively broad and deep, encircled by a narrow rounding of the base, almost approaching a blunt carination. The topotype described measures

Long. 3.7, lat. 2.3; apert. alt. 1.2, lat. 1.2; last whorl 1.7 mm.

Hab. CAPE PROVINCE. Kragga Kama, Port Elizabeth (type, Crawford; Reeve); The Gorge, Somerset East (Mrs. Howard).

The peculiar angulation around the umbilicus renders this species easily recognisable.

Lauria longa sp. n. (Pl. xii, f. 12.)

Shell small, cylindrical, umbilicate, thin, smooth, glossy, transparent, corneous brown. Spire produced, sides regular and nearly straight, apex broadly rounded. Whorls  $8\frac{1}{2}$ , not very convex, first 4 regularly increasing in length and breadth, remainder nearly equal; first 2 smooth, remainder sculptured with very faint, close, straight, oblique striolae; suture simple, well defined. Aperture quadrate, rounded at base, peristome slightly expanded, dental processes 3; a short, acute angular lamella; a flat tubercle below the sinus and a smaller one half-way up the columella, which is otherwise straight, erect, and rather long.

Long. 4.2, lat. 1.7; apert. alt. 0.75, lat. 0.5; last whorl 1.9 mm.

Hab. CAPE PROVINCE. Wellington Mountains, 1500 feet (Barnard).

Type in South African Museum.

The elongate form of this new species and its slightly different dentition distinguishes it from others of the genus, while its occurrence in the heart of the "Lauria" country of the Cape Province tends to the probability, in which Tomlin concurs, that it is rightly placed. It is exceeded in length by the newly described L. bequaerti Pilsb., from the Belgian Congo, but that species, which measures  $4.35 \times 2.2$  mm., is likened to L. desiderata Preston, so cannot bear much resemblance to the one now described.

#### Subfamily VERTIGININAE.

Animal oviparous, usually without lower tentacles, penis simple, without appendages, retractor muscle simple, attached to epiphallus. Hermaphrodite gland divided into 2 groups of short, wide acini; male organs frequently absent. Jaw formed by concrescence of relatively few wide plates, separated by grooves, central tooth tricuspid, laterals bi- or tri-cuspid with interstitial cusplets, ectocone often about as long as mesocone, marginals usually tricuspid with numerous interstitial cusplets.

Genus Vertigo Müll., 1774 (Verm. Hist., ii, p. 124) (= Isthmia Gray, 1821, Alaea Jeff., 1830, etc.). Type V. pusilla Müll.

Small compact pupillids with very blunt summit, aperture usually with the 6 typical teeth of the family, none of them concrescent, angular, when present, not marginal.

#### Vertigo antivertigo (Drap.). (Pl. xii, f. 14.)

1801. Pupa antivertigo Drap., Tabl. Moll. Fr., p. 57. D.

1919. Vertigo antivertigo Drap., Pilsb., Manual, xxv, p. 163, pl. xvi, f. 4-6. D.F.

1925. Vertigo antivertigo Drap., Stnbg., Ét. Maillots, pp. 12, 79, 136, pl. xviii, f. 1-3; pl. xix, f. 1-2; pl. xxx, f. 2. A.

1935. Vertigo antivertigo Drap., Gardner, Q.J. Geol. Soc., xci, p. 486, pl. xxx, f. 31-35. D.F.

In view of the figure here given it appears unnecessary to refer to any further literature concerning this common European species.

Shell minute, rimate, broadly ovate, nearly smooth, glossy, corneous brown. Whorls 5, very convex, last 3 sculptured with extremely weak microscopic growth striolae. Aperture triangular, rounded at base, peristome slightly expanded, straight and vertical in profile, main dentition 6-fold; a strong, long parietal and shorter angular lamella; a strong mid-labral fold with a shorter one below it; a tubercle on left of base and a strong lamella at top of columella; other small processes are frequently present, as in the shell figured, where there is a small labral denticle in the sinus; columellar margin triangularly reflexed over the rima. Length, as given by Pilsbry, from 1.95 to 2.25; lat. 1.2 to 1.4 mm.

Hab. BECHUANALAND. Tlapings Laagte Well, Vryburg (subfossil, Rogers).

Type ubi?, not in the Draparnaud collection.

A widespread palaearctic form, extending to N.W. Africa and, in subfossil condition, to the Kharga Oasis in Egypt, but its occurrence in Bechuanaland would be almost inexplicable were it not that it is accompanied there by Zonitoides africanus Bttg., which appears practically inseparable from the European nitidus Drap., which has been found with antivertigo in the Kharga Oasis. Other species occurring in the piece of rock collected by Rogers at Tlapings Laagte Well, which he informs me was not found down a well, but is merely a surface deposit of uncertain age, are L. truncatula Müll., P. fontana Küst., and what appears to be Punctum hottentotum (M. & P.).

> Genus Truncatellina Lowe, 1852 (A.M.N.H., ix, p. 275) (=Laurinella Hesse, 1915).Type Pupa linearis Lowe.

Shell minute, with obtusely rounded summit and very convex whorls; teeth 1-3, parietal, columellar and lower palatal, last 2 deeply immersed, or none at all. Animal without inferior tentacles.

#### Truncatellina iota (M. & P.). Ref. List No. 349.

1894. Pupa iota M. & P., A.M.N.H., xiv, p. 93, pl. i, f. 10. D.F. 1921. Truncatellina iota M. & P., Pilsb., Manual, xxvi, p. 95, pl. x, f. 6–7. D.F.

Shell very small, cylindrical, rimate, thin, silky, transparent, pale corneous brown. Spire produced, sides regular, apex mamillate. Whorls 7, very convex, last 6 very gradually increasing, almost equal in size, first  $1\frac{1}{2}$  practically smooth, remainder sculptured with strong, nearly straight, slightly oblique costulae, increasing very gradually in distance apart; suture simple, impressed. Aperture squarely subquadrate, rounded at base, peristome slightly reflexed, labrum straight and erect in profile, columella erect, margin triangularly reflexed, callus none; the slight columellar reflexion nearly covers the small rima. The shell described, from Pretoria, measures

Long. 2·3, lat. 0·75; apert. alt. 0·7; last whorl 0·9 mm.

The number of whorls varies from 6 to 8 in a series from this locality, and the length of shell somewhat in proportion.

Hab. TRANSVAAL. Pretoria (type, Farquhar; Connolly); Heidelberg (Miss Livingston); Standers Kop (Connolly).

NATAL. Hilton (Falcon); Balgowan (Pennington).

ZULULAND. Dukuduku Forest (Toppin).

CAPE PROVINCE. Knysna (J. L. B. Smith); Kowie (Gowie). Type in British Museum.

#### var. livingstonae M. & P. Ref. List No. 349.

1908. Pupa iota M. & P., var. livingstonae Bnp., M. & P., A.M.N.H., i, p. 77, pl. i, f. 12. D.F.

1921. Truncatellina iota M. & P., mut. livingstonae Bnp., Pilsb., Manual, xxvi, p. 97, pl. x, f. 8–10. D.F.

Differs from type in the presence of a well-marked, oblique, shortly entering fold, far within the aperture, which might be termed, from its situation, either basal or lower palatal, but is clearly visible, when present, in a frontal aspect.

Hab. TRANSVAAL. Pretoria (type); Standerton (Connolly).

NATAL. Balgowan (Pennington); Hilton (Falcon).

ZULULAND. St. Lucia Lake (Haas).

Type in British Museum.

#### Truncatellina pretoriensis (M. & P.).

Ref. List No. 352.

1893. Pupa pretoriensis M. & P., A.M.N.H., xi, p. 21, pl. iii, f. 8. D.F.

1908. Pupa dysorata M. & P., var. intradentata Bnp., M. & P., A.M.N.H., i, p. 73, pl. i, f. 5-6. D.F.

1921. Truncatellina pretoriensis M. & P., Pilsb., Manual, xxvi, p. 92, pl. x, f. 1-3. D.F.

A minute cylindrical shell, with  $5\frac{1}{2}$  very convex whorls; the sculpture is similar to that of *iota*, var. *livingstonae*, but weaker, and there is a small deep-set basal tubercle in the same position as in that form, from which it is easily distinguishable, even to the naked eye, by its minute size.

Long. 1.5, lat. 0.7 mm.

Hab. TRANSVAAL. Pretoria and District (pretoriensis and intradentata, Farquhar; Connolly).

Types in British Museum; that of *pretoriensis* is fragmentary, but enough remains to prove its identity with Burnup's godchild.

#### Truncatellina dysorata (M. & P.). Ref. List No. 345.

1893. Pupa dysorata M. & P., A.M.N.H., xi, p. 20, pl. iii, f. 4. F. and faulty description.

1921. Truncatellina dysorata M. & P., Pilsb., Manual, xxvi, p. 94, pl. x, f. 4. D.F.

A minute, umbilicate, cylindrical shell with  $5\frac{1}{2}$  convex whorls, the apical smooth, remainder deeply, closely, transversely striate; aperture subquadrate, rounded at base, slightly thickened and expanded, with no dental process. Long. 1.57, lat. 0.9 mm.

Hab. CAPE PROVINCE. Griqualand East (coll. Sykes).

Type in British Museum.

Slightly more cylindrical, with less ventricose whorls and shallower suture than *pretoriensis*, from which it further differs in being umbilicate instead of rimate, and in the complete absence of dentition.

#### Truncatellina quantula (M. & P.).

Ref. List No. 353.

1893. *Pupa quantula* M. & P., A.M.N.H., xi, p. 20, pl. iii, f. 5. *D.F.* 1921. *Truncatellina quantula* M. & P., Pilsb., Manual, xxvi, p. 95, pl. x, f. 5. *D.F*.

Resembles the foregoing in its cylindrical form, but easily distinguished by its greater length, comparative narrowness, rounder aperture and much finer, closer sculpture, which is hardly visible under a hand-lens; there is no dentition.

The shell contains 6 convex whorls and measures  $1.87 \times 0.9$  mm. in length and

breadth.

Hab. CAPE PROVINCE. Port Elizabeth, south of Baakens River to Schoenmakers Kop (Crawford).

Type lost.

#### Truncatellina sykesii (M. & P.).

Ref. List No. 354.

1893. Pupa sykesii M. & P., A.M.N.H., xi, p. 21, pl. iii, f. 6. F. and faulty description.

1898. Pupa pentheri Stur., S.A. Moll., p. 70, pl. ii, f. 34-36. D.F.

1921. Truncatellina sykesii M. & P., Pilsb., Manual, xxvi, p. 97, pl. x, f. 11, 14–17. D.F.

1921. Truncatellina pentheri Stur., Pilsb., ibid., p. 98, pl. x, f. 13. D.F.

1925. Truncatellina sykesi Conn., Trans. R. Soc. S. Africa, xii, p. 165. N.

A minute, rimate, cylindriform shell, but more tapering than the last, smooth, glossy, corneous brown. Whorls  $6\frac{2}{4}$ , very convex, 1st smooth, remainder sculptured with close, somewhat irregular, slightly oblique striolae, so faint as to be scarcely visible under the microscope; suture simple, deep. Aperture quadrate, rounded at base, peristome minutely thickened, columella erect, margin triangularly reflexed, dentition none.

Long. 1.82, lat. 0.83 mm.

Hab. CAPE PROVINCE. Griqualand East (type in coll. Sykes); Port Elizabeth (Reeve); Pirie (Godfrey); Grahamstown (Farquhar); The Gorge, Somerset East (Mrs. Howard).

NATAL. Majuba (Connolly); Durban; Umbilo Road (pentheri, Penther); Edendale; Game Pass; Ntimbankulu; van Reenen (Burnup); Sinkwazi; Balgowan (Pennington); Cathkin; Karkloof Falls (Falcon).

LORENZO MARQUES. Mt. Vengo, 5500 feet (Cressy).

Type of sykesii in British, pentheri in Vienna Museum.

The sculpture in the Port Elizabeth race is considerably stronger than in the type.

var. inconspicua Bnp.

Ref. List No. 354.

1908.  $Pupa\ sykesii\ M.\ \&\ P.,\ A.M.N.H.,\ i,\ pp.\ 157–8,\ pl.\ ii,\ f.\ 21.\ D.F.$ 

1911. Pupa sykesi M. & P., var. inconspicua Bnp., A.M.N.H., vii, p. 410. N.

1921. Truncatellina sykesii inconspicua Bnp., Pilsb., Manual, xxvi, p. 98, pl. x, f. 12. D.F.

An elongate, narrow, fusiform variety, resembling the type except for being longer and narrower; the largest example has  $7\frac{1}{2}$  whorls and measures  $2\cdot05\times0\cdot72$  mm., while a second example is  $1\cdot94\times0\cdot77$  mm. in length and breadth.

Hab. NATAL. Dargle (Miss Livingston). Type in British Museum.

#### Truncatellina perplexa (M. & P.). Ref. List No. 351.

1908. Pupa perplexa Bnp., M. & P., A.M.N.H., i, p. 80, pl. ii, f. 17–18. D.F.

1921. Truncatellina perplexa Bnp., Pilsb., Manual, xxvi, p. 91, pl. ix, f. 24–25. D.F.

A minute, cylindrical shell, with 5 whorls, similar in sculpture to *iota*, but with 3-fold dentition; a small inset parietal lamella; a blunt, oblong fold, like a low mound, inset on the columella, and a small, deep-set basal fold in the same position as in the var. *livingstonae*.

Long. 1.75, lat. 0.9 mm.

Hab. CAPE PROVINCE. Cradock (type); Port Elizabeth (Farquhar); Maclear (in coll. Wotton).

TRANSVAAL: Johannesburg (McBean); Potchefstroom (Miss Livingston); Heidelberg (Connolly); Pretoria (?) in coll. Ponsonby.

ORANGE FREE STATE. Bloemfontein (Connolly); Thaba Nchu (Falcon).

Type in British Museum.

The Port Elizabeth race has a whorl more than the normal, and is slightly longer in consequence, while the basal fold is so far inset as usually to be only distinguishable by a white patch through the back of the shell. The single example from Maclear lacks the parietal lamella.

#### Subfamily Nesopupinae, Steenberg, 1925.

Shell and animal substantially like the Vertigininae except that the penis bears an appendix and the retractor muscle is forked; some of the genera are viviparous.

Genus Nesopupa Pilsb., 1900 (Proc. Acad. Nat. Sci. Phila., p. 432) (=Ptychochilus Bttg., 1881, preoc.). Type Pupa tantilla Gld.

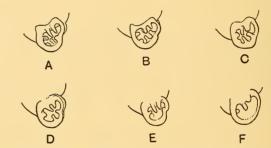
Shell minute, oval or ovate, rimate, aperture with angular, parietal and columellar lamellae and usually with palatal folds; lip expanded. Animal lacking inferior tentacles.

> Section Afripupa Pilsb. & Cooke, 1920 (Manual, xxv, p. 276).

Type Pupa griqualandica M. & P.

Sculpture of close rib-striae without cuticular edges; the columellar lamella does not turn down at its inner end.

Text-fig. 31 shows the dentition of the six known S. African species.



Text-fig. 31.—Apertural dentition of South African Nesopupa, highly magnified.

A. N. griqualandica (M. & P.).

B. N. bandulana Conn.
C. N. farquhari Pilsb.
D. N. bisulcata rhodesiana Pilsb.

E. N. vengoensis Conn.

F. N. corrugata (Prest.).

Nesopupa griqualandica (M. & P.).

(Text-fig. 31, A.)

Ref. List No. 348.

1893. Pupa griqualandica M. & P., A.M.N.H., xi, p. 22, pl. iii,

1920. Nesopupa griqualandica M. & P., Pilsb., Manual, xxv, p. 357, pl. xxxiv, f. 1–4. D.F.

1929. Nesopupa griqualandica M. & P., Pilsb., Ann. Natal Mus., vi, p. 303. N.

Shell minute, ovate, rimate, thin, silky, glossy, transparent, pale corneous brown. Spire moderately produced, apex rounded. Whorls  $4-4\frac{1}{2}$ , very convex, first  $1\frac{1}{4}$  smoothly pitted, remainder sculptured with close, regular, nearly straight, slightly oblique transverse costulae; suture simple, impressed. Aperture quadrate, rounded at base, peristome expanded, dentition 6-fold; a short, acute, inrunning parietal lamella; a shorter angular lamella, hollowed on the right, arising at the lip edge and entering less deeply than the former; a short, deeply entering simular fold; a square denticle somewhat inset at the left centre of the base; an oblique, inrunning lamella further inset behind it, and an acute horizontal columellar lamella; the dental processes show white on the exterior of the shell, but correspond to no external depressions. A shell from Pretoria measures

Long. 1.5, lat. 0.9 mm.

All the above processes are present in the type, but the basal denticle is very weak, and the shell is somewhat weathered, so that the early sculpture is obliterated.

Hab. CAPE PROVINCE. Griqualand East (type, coll. Sykes); Cradock (Farquhar); Port Elizabeth (coll. Ponsonby); Kowie; East London (Kincaid).

TRANSVAAL. Pretoria District (Farquhar and others); Heidelberg (Miss Livingston); Buiskop (Connolly).

NATAL. Pietermaritzburg; Tongaat; Edendale (Burnup); Sinkwazi (Pennington); Winkle Spruit (Akerman); Bushman's River Falls (Thomasset); Hilton (Falcon).

ZULULAND. Dukuduku (Toppin); Mfongosi (Jones).

S. RHODESIA. Victoria Falls (Connolly).

Type in British Museum.

# Nesopupa farquhari Pilsb. (Pl. xii, f. 15, and text-fig. 31, C.)

1917. Nesopupa farquhari Pilsb., Nautilus, xxxi, p. 50. D. 1920. ,, ,, ,, Manual, xxv, p. 358, pl. xxxiv, f. 7-9. D.F.

Very similar to the foregoing, with  $4\frac{1}{2}$  whorls; parietal and sinual processes much as in griqualandica, but there is an inrunning lower palatal fold, the basal is a small round tubercle situate on the left of the base, and the columellar lamella is rather higher than in M. & P.'s species. One of the original lot measures Long. 1.6, lat. 1.0 mm.

Hab. CAPE PROVINCE. Grahamstown (type, Farquhar); Kowie (Kincaid).

Type in Academy of Natural Sciences, Philadelphia.

Nesopupa vengoensis Conn.

(Text-fig. 31, E.)

1925. Nesopupa (Afripupa) vengoensis Conn., Trans. R. Soc. S. Africa, xii, p. 165, pl. iv, f. 23. D.F.

1934. Nesopupa vengoensis Conn., Pilsb., Manual, xxviii, p. 111, pl. xxi, f. 9. D.F.

A minute shell resembling *griqualandica* in almost every detail, but with slightly weaker sculpture, while the lower palatal fold is absent and the basal tooth so much more deep-set that in some specimens it is hardly visible.

Long. 1.6, lat. 0.8; apert. alt. 0.5, lat. 0.5; last whorl 1.0 mm.

Hab. LORENZO MARQUES. Mt. Vengo, 5500 feet (Cressy). Type in British Museum.

Nesopupa bisulcata rhodesiana Pilsb.

(Text-figs. 31, D, and 32.)

Ref. List No. 339.

1912. Jaminia bisulcata Jick., Conn., Ann. S.A. Mus., xi, p. 178. N. 1920. Nesopupa bisulcata rhodesiana Pilsb., Manual, xxv, p. 359, pl. xxxiv, f. 5-6. D.F.



Text-fig. 32.

Nesopupa bisulcata rhodesiana Pilsb., Victoria Falls, highly magnified.

There are 5 whorls; both parietal processes rather weaker than in *griqualandica*, upper and lower palatals not entering, but both marked by plain white lines, scarcely furrows, on the outside of the shell; there is no basal fold, and the columellar lamella, shorter than in *griqualandica*, is situate half-way up the columella. A topotype measures

Long. 2.0, lat. 1.1 mm.

Hab. S. RHODESIA. Victoria Falls (Connolly). Type in Academy of Natural Sciences, Philadelphia.

Pilsbry considers that this race differs so much in contour from Jickeli's figures that, taking the locality and faunal zone into consideration, he is disposed to give it subspecific standing.

Section Insulipupa Pilsb. & Cooke, 1920

(Manual, xxv, p. 277).

Type  $Pupa\ minutalis$  Morel.

Angular lamella low throughout, straight, joining the outer lip; surface pitted; form rather cylindrical.

### Nesopupa corrugata (Prest.).

(Text-fig. 31, F.)
Ref. List No. 340

Ref. List No. 340.

1912. Jaminia corrugata Prest., A.M.N.H., ix, p. 70, f. 4; p. 71. F.D.

1920. Nesopupa corrugata Prest., Pilsb., Manual, xxv, p. 361, pl. xxxiv, f. 12, 15. D.F.

1925. Nesopupa (Afripupa) corrugata Prest., Conn., Trans. R. Soc. S. Africa, xii, p. 164. N.

Shell very small, cylindrical, rimate, smooth, transparent, corneous yellowbrown. Spire produced, sides parallel, apex rounded. Whorls  $\mathfrak{I}_2^1$ , convex, gradually increasing, first  $1\frac{1}{2}$  practically smooth, remainder sculptured with very weak, oblique microscopic striolae, the whole surface bearing a strongly corrugate or malleate aspect; suture simple, well defined. Aperture quadrate, rounded at base, peristome slightly expanded, labrum straight and erect, dentition 4-fold: a shortly entering parietal and a short, weak angular lamella; a minute lower palatal tubercle and one slightly larger half-way up the columella. The finest of the original lot in my collection measures

Long. 2.7, lat. 1.2 mm.

Hab. S. RHODESIA. Victoria Falls (type, Connolly).

LORENZO MARQUES. Bandula Siding, B. & M. Rly. (McDowell).

Type in Tervueren Museum.

It is seldom that all 4 dental processes are present, the labral tubercle being usually deficient; the Bandula examples are shorter than type, but otherwise typical.

#### Section uncertain.

#### Nesopupa bandulana Conn.

(Text-fig. 31, B.)

1922. Nesopupa bandulana Conn., A.M.N.H., x, p. 119. D.

1925. ,, (Afripupa) bandulana Conn., Trans. R. Soc. S. Africa, xii, p. 165, pl. iv, f. 24. D.F.

1926. Nesopupa bandulana Conn., Pilsb., Manual, xxvii, p. 226, pl. xxix, f. 15. D.F.

The dark brown shell agrees in most respects with griqual andica, but the  $4\frac{1}{2}$  whorls are rather less convex and sculptured only with microscopic striolae. The parietal lamella is weak, and the angular very small and not nearly connecting with the lip; both palatals strong and rather deep-set, basal similar and to left of them, columellar lamella deep-set, horizontal, as in griqual andica; there is a small sinular pit, but no other external depression.

Long. 1.5, lat. 1.0 mm.

Hab. LORENZO MARQUES. Near Bandula Siding, B. & M. Railway (McDowell).

Type in British Museum.

Pilsbry remarks that this is not an Afripupa, but leaves it for the present in Nesopupa.

Genus *Pupisoma* Stol., 1873
(J. Asiatic Soc. Bengal, xiii, 2, p. 32).

Type *P. lignicola* Stol.

Shell very small, globose, with very convex whorls and blunt apex, animal viviparous, without inferior tentacles; central tooth tricuspid, laterals with 3 cusps or inner cusp suppressed, marginals with 4 or 5 unequal cusps; penis with short appendage.

Section *Ptychopatula* Pilsb., 1889 (Proc. Acad. Nat. Sci. Phila., p. 191).

Type *Helix caeca* Guppy.

Shell globose-conic, of  $3\frac{1}{2}$ -4 whorls, striate or regularly ribbed, usually with spiral lines, columella concave, simple, margin dilated.

In restoring *Pupisoma* to the present family, Pilsbry stresses the absence of the lower pair of tentacles and suggests that it may be regarded as an arboreal derivative of *Nesopupa*, which has been modified like the Hawaiian species of *Pronesopupa* (also arboreal or foliicolous) by decadence or loss of teeth in the aperture and simplification of the peristome; Thiele, however, has retained the genus in the Valloniidae.

Pupisoma orcula (Bs.). (Text-fig. 33.) Ref. List No. 297.

1850. *Helix orcula* Bs., A.M.N.H., vi, p. 251. *D*.

1916. *Pupisoma orcula* Bs., Conn., Ann. S.A. Mus., xiii, p. 186. *N*. 1920. ,, ,, Pilsb., Manual, xxvi, p. 31, pl. ii, f. 1-5. *D.F*.

1922.  $Pupisoma\ orcula$  Bs., Conn., Proc. Mal. Soc., xv, p. 76. L.

Shell very small, roundly ovate, narrowly umbilicate, slightly silky, dark corneous brown. Whorls 3-4, convex, rounded at periphery, rapidly increasing, sculptured almost to extreme apex with close, regular, curved, oblique transverse striae, between which appear extremely fine, close, regular, microspiral lines; suture well defined. Aperture nearly circular, labrum receding to the base, columella concave, inclined inwards, margin triangularly reflexed over the narrow

umbilicus. The shell figured, from Edendale, is 1.66 × 1.69 mm., while others measured by Burnup were  $1.57 \times 1.75$ ,  $1.62 \times 1.88$ ,  $2.00 \times 1.74$ , and  $2.18 \times 1.94$  mm. in height and breadth, disclosing considerable variation in ratio between these dimensions.

Hab. CAPE PROVINCE. Port Elizabeth (Crawford); Grahamstown (Farquhar); Somerset East (Mrs. Howard).

NATAL. Pietermaritzburg; Ntimbankulu; Dargle; Edendale; Game Pass; Upper Mooi R. (Burnup); Winkel Spruit (Akerman).

TRANSVAAL. Pretoria (Connolly); Elim; Mt. Manotsuri, Shiluwane Dist. Sibasa; (Junod).

RHODESIA. Victoria Falls (Warren). Originally described from India; paratypes some orcum (DS.), Nat-kloof; ×12 approximately. in British Museum.



Text-fig. 33. — Pupi-

#### Pupisoma japonicum Pilsb.

(Text-fig. 34.)

Ref. List No. 296.

1902. Pupisoma japonicum Pilsb., Nautilus, xvi, p. 21. D.

1916. Conn., Ann. S.A. Mus., xiii, p. 186. N.

1920. Pupisoma japonicum Pilsb., Manual, xxvi, p. 25, pl. ii, f. 11–12. D.F.

Smaller than the foregoing, less variable in contour, height just exceeding breadth, the transverse striae are slightly weaker and there is practically no sign



Text-fig. 34.—Pupisoma japonicum Pilsb., Karkloof; ×12 approximately.

of microspiral sculpture: the columellar reflexion is narrow and the umbilicus less concealed from basal view-point. The shell figured, from Karkloof, is  $1.34 \times 1.30$  mm., and others measured by Burnup were  $1.22 \times 1.16$ ,  $1.32 \times 1.24$ ,  $1.35 \times 1.32$ , and  $1.41 \times 1.37$  mm.

Hab. NATAL. Pietermaritzburg; Ntimbankulu; Edendale; Karkloof; Game Pass (Burnup).

Described from Japan; type in Academy of Natural Sciences, Philadelphia.

#### FAMILY ENIDAE.

Shell ovate to turriform, teeth of radula usually with an ectocone, which becomes split on the marginals. Genitalia with or without spermatophore sac on stalk of receptaculum seminis, which is often very long; penis, except in Jaminiinae, with glandular appendage, of which the basal portion contains a branch of the penial retractor; epiphallus usually with a short blind sac on its end and often a small protuberance in the middle.

Subfamily Pachnodinae Steenberg, 1925 (Ét. Maillots, p. 202).

Shell very small to rather large, conoid, ovate or turriform, nearly always perforate, aperture usually toothless, nearly always with reflexed columellar margin. Radula diversified, central tooth single or tricuspid, laterals usually with outer cusp, marginals usually with ectocone split in two and outer teeth frequently pectinate; in most genera the marginal teeth are placed more or less obliquely, so that the outer side of one is in front of the inner side of the tooth next beyond. The anatomy of *Pachnodus* has been treated fully by Wiegmann \* and that of *Rachis punctata* (q.v.) by Seshaiya; the kidney is orthurethrous, receptacular duct without diverticulum, penis with well-developed appendage; the little cul-de-sacs of proximal portion of hermaphrodite duct, so characteristic of the Palaearctic Enidae, are lacking.

Genus Rhachidina Thiele, 1911 (Deutsch. Zent.-Afr.-Exp., p. 201). Type Bulimus tumefactus Rve.

Shell small to medium, thin, acuminate ovate, narrowly umbilicate, smooth, fairly glossy, whitish with brown spots and bands, peristome acute, often expanded. Central tooth of radula short, blunt and single, laterals and marginals with rounded edges, 1 small acute inner and usually 2 outer cusps.

<sup>\*</sup> Mitth. Zool. Samml. Mus. Naturk. Berlin, 1898, i, p. 81.

(Pl. xiii, f. 3-5.)

Ref. List No. 324.

1890. Rhachis usagarica Smith, A.M.N.H., vi, p. 152, pl. v, f. 5. D.F.

1897. Buliminus (Rhachis) melanacme Pfr., var. usagaricus Smith, Mts., D.-O.-A., iv, p. 76. N.

1898. Buliminus (Rhachis) pentheri Stur., S.A. Moll., p. 65, pl. ii, f. 47-48. D.F.

1900. Buliminus (Rhachis) usagaricus Smith, Kob., Conch. Cab., p. 643, pl. xcix, f. 5. D.F.

1925. Rhachidina usagarica Smith (= pentheri Stur.), Conn., Trans. R. Soc. S. Africa, xii, p. 161. N.

Shell of good size, broadly acuminate ovate, thin, smooth, glossy, first 2 or 3 whorls usually brown, later pale cream with a number of small, irregular blackish spots, usually with 1 or 2, rarely 3 or 4 narrow brown bands, or bandless. Sides straight, summit conical, apical angle  $67^{\circ}$ . Whorls  $5\frac{3}{4}$ , moderately convex, rounded at periphery, rapidly increasing, first  $2\frac{1}{2}$  smooth, remainder sculptured with faint, fine, close, straight, slightly oblique striolae and, on the upper surface, patches of extremely weak spiral grooving; suture well defined. Aperture suboval, peristome simple, labrum straight, receding but little in profile, columella erect, margin triangularly reflexed, half covering the umbilicus.

Alt. 15.5, lat. 11.5; apert. alt. 9.2, lat. 6.2; last whorl 12.3 mm.

Hab. LORENZO MARQUES. Mtisherra R. Valley; Dondo; Chimoio District (Cressy); Matolla (pentheri, Penther).

Type of usagarica in British, pentheri in Vienna Museum.

Described from Usagara and ranging into Kenya and Uganda.

The typical form has 2 bands, 1 at the periphery and 1 below it, but some lack the lower band, some are bandless and others with a band both above and below periphery; a rare variety is quadrifasciate, with 4 bands between periphery and umbilicus. My reasons for considering this species distinct from the next are given thereunder. R. sesamorum Bgt., described with 1 band but figured with 2, probably represents usagarica, with which it agrees in texture and colour, rather than melanacme, to which some authors have attributed it (v. infra).

Rhachidina melanacme (Pfr.).

(Pl. xiii, f. 8.)

Ref. List No. 317.

1855. Bulimus melanacme Pfr., P.Z.S., p. 96, pl. xxxi, f. 8. D.F. 1889. Pachnodus sesamorum Ancey, Bgt., Moll. Afr. équat., p. 66, pl. iii, f. 2-3. D.F.

1901. Buliminus (Rhachis) sesamorum Bgt., Kob., Conch. Cab., p. 810, pl. exviii, f. 19. D.F.

1925. Rhachidina melanacme Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 161. N.

Although agreeing with the last in every other respect, this appears to be separable by its more solid, quasi-calcareous texture, greater gloss and milky, almost bluish-white ground; the first 2 or 3 whorls are black and there is usually a very narrow dark peripheral band, sometimes absent, and rarely a second on the base, which does not, however, extend to the aperture. Whorls 6, apical angle 68°, Alt. 17·0, lat. 11·4; apert. alt. 7·5, lat. 5·8; last whorl 11·5 mm.

Hab. LORENZO MARQUES. Tette (type, Peters, fide Pfeiffer).

Martens states that the above locality is incorrect, as all others of Peters' original set are labelled in his hand Querimba Island (off the coast of Mozambique), and if such be the case, the species does not fall within the limits of the present work.

The type appears to be lost; there are immature paratypes in the British and Berlin Museums and elsewhere.

# Rhachidina mozambicensis (Pfr.). (Pl. xiii, f. 6.) Ref. List No. 320.

1846. Bulimus mozambicensis Pfr., Symb., iii, p. 85. D.

1879. Buliminus spekei Bgt., Descr. Moll. Égypte, p. 4. D.

1925. Rhachidina mozambicensis Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 162. N.

Shell of good size, acuminate ovate, smooth, rather dull, translucent, first 2 whorls dark brown, ground colour of remainder creamy white, with a narrow peripheral band of dark brown and rarely a second, fainter, on base; above the periphery the whorls are painted with close, fairly regular, more or less continuous, straight, slightly oblique transverse brown lines, with bands of brown dots, variously arranged, and irregular black dots, which are also present on the otherwise unornamented base. Sides straight, summit acute, apical angle 61°. Whorls 6½, moderately convex, first 2 smooth, remainder bearing extremely fine, weak, straight, slightly oblique transverse striolae; suture well defined. Aperture suboval, peristome narrowly expanded, labrum straight and only slightly receding, columella erect, margin narrowly reflexed, almost concealing the narrow umbilicus. Alt. 18·5, lat. 12·0; apert. alt. 9·9, lat. 5·7; last whorl 13·7 mm.

#### Hab. LORENZO MARQUES. Rikatla (fide Junod).

Type in British Museum.

A striking form, whose ornamentation amply distinguishes it from all others. It was described from Mozambique and its record from Rikatla is of questionable accuracy; nevertheless it seems inadvisable to expunge it from the South African list, as it is almost certain to A Monographic Survey of South African Non-marine Mollusca. 417

occur in the little explored districts along the south bank of the Zambesi.

Rhachidina dubiosa (Stur.).

(Pl. xiii, f. 7.)

Ref. List No. 312.

1898. Buliminus (Rhachis) dubiosus Stur., S.A. Moll., p. 64, pl. ii, f. 45-46. D.F.

1925. Rhachidina dubiosa Stur., Conn., Trans. R. Soc. S. Africa, xii, p. 162.  $\,N.$ 

1936. Rachis dubiosa Stur., Haas, Abh. Senckenb. Ges., No. 431, p. 21. L.

Resembles the foregoing in form, but is more glossy, with paler apex; ground colour cream, with a narrow brown band around the periphery and a second about the middle of the base, upper part of whorls painted with 2 spiral rows of brown dots, sometimes united vertically to form continuous transverse streaks; one example shows an additional infrasutural roseate band. Sides straight, apical angle 50°. Whorls 7½, flattish, first 2 smooth, remainder sculptured all over with extremely weak, fine, straight, slightly oblique transverse striolae and clear, fine, slightly undulating microspiral lines. Aperture suboval, peristome simple, columella concave, margin narrowly reflexed, almost covering the narrow umbilicus. The largest example recorded measures

Alt. 20.5, lat. 11.3; apert. alt. 9.3, lat. 7.0; last whorl 12.6 mm.

Hab. LORENZO MARQUES. Matolla (type, Penther); Dondo (Cressy).

ZULULAND. Mazimba Hill (Haas).

Type in Vienna Museum.

The microspiral sculpture in this and the next species distinguish them from other South African members of the genus, but their exact affinity with more than one of the Central African forms, such as *braunsi* Mts., must rest undetermined until much fuller material is available for examination.

#### Rhachidina chiradzuluensis (Smith).

(Pl. xiii, f. 14.)

1899. Buliminus (Rhachis) chiradzuluensis Smith, P.Z.S., p. 586, pl. xxxiii, f. 40. D.F.

1900. Buliminus (Rhachis) chiradzuluensis Smith, Kob., Conch. Cab., p. 658, pl. ci, f. 3. D.F.

1922. Rhachis chiradzuluensis Smith, Conn., Proc. Mal. Soc., xv, p. 76. N.

The Transvaal shell that I attribute to this species is small, very thin and fragile, smooth, moderately glossy, pale yellow with 3 chestnut bands, broader round periphery and on base, very narrow between the former and upper suture. Sides VOL. XXXIII.

straight, apical angle  $62^{\circ}$ . Whorls 6, not very convex, last 4 sculptured as the foregoing, with faint transverse striolae and clear microspiral lineation. Aperture suboval, peristome simple, columella somewhat concave, margin narrowly, almost adnately reflexed, nearly concealing the minute umbilicus.

Alt. 13.7, lat. 9.0; apert. alt. 7.2, lat. 4.1; last whorl 10.3 mm.

Hab. TRANSVAAL. Mt. Manotsuri, Shiluwane District (Junod). Type in British Museum.

Described from Nyasaland and ranging as far north as Mombasa; the type set all have but two narrow bands, one about the periphery and one on base; in the Transvaal examples these bands are twice as broad, and there is a narrow third band above the periphery, midway between the sutures, but in other respects the shells are perfectly conspecific.

Rhachidina spilogramma (Mts.).

(Pl. xiii, f. 12.)

Ref. List No. 330.

1859. Bulimus spilogrammus Mts., Mal. Blätt., vi, p. 214, pl. ii, f. 9. D.F.

1925. Rhachidina spilogramma Mts., Conn., Trans. R. Soc. S. Africa, xii, p. 163. N.

Shell small, short turriform, very thin, transparent, not very glossy, first 3 or 4 whorls usually brown, ground of remainder cream with a narrow brown peripheral band, the space between which and the upper suture is occupied by broad patches or irregularly shaped streaks of brown, which are in rare instances absent, leaving the peripheral band as sole ornamentation. Sides straight, summit acute, apical angle 56°. Whorls 7, flattish, the later sculptured with very fine and close, straight, oblique transverse striolae; suture well defined. Aperture oblique, suboval, peristome very narrowly expanded except for a short distance below the suture, labrum straight and receding somewhat in profile, columella inclined to left, margin little reflexed, only just overhanging the narrow umbilicus. The largest specimen at hand measures

Alt. 12.0, lat. 7.7; apert. alt. 6.0, lat. 3.7; last whorl 8.9 mm.

Hab. LORENZO MARQUES. Tette (type, Peters); Mtisherra R. Valley (Cressy).

The slight expansion of the peristome distinguishes this little shell from the young of larger forms.

Type in Berlin Museum.

Genus Rhachistia Conn., 1925 (Trans. R. Soc. S. Africa, xii, p. 163). Type Buliminus rhodotaenia Mts., 1901 (=Eorrhachis Toml. & Peile, 1930).

Shell comparatively large, short turriform, solid, smooth, fairly glossy, with dark spots and brown or purple bands on ground of

rose, buff, flesh, or cream. Aperture ovate, peristome acute, not expanded. Teeth of radula large, lobe-shaped, central single, blunt or round.

Rhachistia sticta (Mts.). (Pl. xiii, f. 19.) Ref. List No. 331.

1859. Bulimus (Rhachis) stictus Mts., Mal. Blätt., vi, p. 211, pl. ii, f. 6. D.F.

1925. Rhachistia sticta Mts., Conn., Trans. R. Soc. S. Africa, xii, p. 164. N.

Shell large, turriform, umbilicate, rather solid, smooth, glossy, cream, sometimes with a narrow infrasutural yellow band, 2 or more broader, of rosy lilac, above and below the periphery, or sometimes with 3 narrow lilac bands above, around, and below the periphery respectively, but always with a variable number of dark spots and blotches on the later whorls. Sides straight, summit acute, apical angle 55°. Whorls 8, rather flat, angulate at periphery of young shells, first 2 smooth, remainder sculptured with close, faint, straight, slightly oblique striolae and exceedingly faint microspiral lines, only visible on freshest specimens; suture well defined. Aperture quadrate, rounded at base and labrum, which is straight and recedes little in profile, columella straight and erect, margin triangularly, sometimes almost adnately reflexed, more or less obscuring the narrow umbilicus. The specimen figured measures

Alt. 24.0, lat.  $12\cdot 4$ ; apert. alt.  $10\cdot 9$ , lat.  $6\cdot 8$ ; last whorl  $15\cdot 1$  mm., but the largest examined is  $29\cdot 1\times 14\cdot 2$  mm.

Hab. LORENZO MARQUES. Tette (type, Peters); Manicaland (Selous); Gorongozo District (Wells Cole); Mtisherra R. Valley; Dondo District; Zangwe Basin (Cressy).

S. RHODESIA. Three miles east of Umtali (Dodds).

ZULULAND. Umbonambi (Toppin); White Umfolosi Flats (Gibson).

Also known from Angoni Land and other localities in Central Africa and Northern Rhodesia.

Type in Berlin Museum.

A magnificent, brightly coloured species, which Cressy's collections prove to attain far greater size than had previously been imagined.

#### $Rhachistia\ rhodotaenia\ ({\rm Mts.}).$

1869. Buliminus (Rhachis) rhodotaenia Mts., von der Deckens Reisen, iii, p. 58, pl. ii, f. 2. D.F.

1901. Buliminus rhodotaenia Mts., Kob., Conch. Cab., p. 750, pl. ex, f. 12-13. D.F.

Another magnificent species, only known within our limits in a varietal form.

#### var. andradensis Germ.

1918. Rachis (Rachis) rhodotaenia Mts., var. andradensis Germ., Bull. Mus. Paris, xxiv, p. 155. D.

1925. Rhachistia rhodotaenia Mts., var. andradensis Germ., Conn., Trans. R. Soc. S. Africa, xii, p. 163. L.

Shell large, turriform, umbilicate, smooth, fairly glossy, summit bright chestnut, later whorls cream, with a narrow black infrasutural band and a zone of palest lilac around the periphery, with irregular groups of brown dots on the last 2 whorls. Whorls 7, regularly increasing, first 2 smooth, remainder sculptured with very fine, close, oblique striolae, a little crisper at the suture, and hardly visible traces of microspiral lines; suture well defined. Aperture oblique, suboval, peristome simple, columella straight, margin triangularly reflexed, partly covering the narrow umbilicus. Germain's measurements of this variety, which I have not examined, are

Alt. 26, lat. 15; apert. alt. 13 mm.

Hab. LORENZO MARQUES. Andrada (Vasse). Type in Paris Museum.

#### Rhachistia böhmi (Mts.).

1895. Buliminus (Rhachis) böhmi Mts., Nachr.-Bl. D. Mal. Ges., xxvii, p. 181. D.

1897. Buliminus (Rhachis) böhmi Mts., D.O.A., iv, p. 70, pl. iii, f. 39. D.F.

1899. Buliminus (Rhachis) böhmi Mts., Smith, P.Z.S., p. 586. N. 1901. ,, ,, ,, Kob., Conch. Cab., p. 803, pl. cxvii, f. 22. D.F.

1910. *Rachis böhmi* Mts., d'Ailly, Kilimandjaro, i, 6, p. 19. *N*. 1919. ,, ,, Pilsb., Bull. U.S. Nat. Mus., xl, p. 306. *N*.

Shell of fair size, acuminate ovate, rimate, very thin, smooth, glossy, pale cream, with a narrow band of deep chestnut round the periphery and a weaker one a short distance below, and a few very small, faint, irregular dark dots. Whorls nearly flat, regularly increasing, bearing weak and slightly oblique transverse striolae and showing in unweathered places very weak, shallow spiral grooves; suture shallow. Aperture subovate, peristome simple, columella straight and erect, margin pale violet, narrowly reflexed over the small rima. The type contains 7 whorls and measures

Alt. 24.0, lat. 13.5; apert. alt. 10.8, lat. 7.0; last whorl 15.5 mm.

Hab. N.E. ZULULAND. Sibangwana district, resting from 5 to 20 feet up on bush and tree stems (Bell Marley).

These 3 specimens are not quite full grown; all show on the early whorls a third brown band half-way between upper and lower suture, but in the two larger shells this dies out somewhere on the penultimate whorl and does not reappear.

The type was described from the east shore of Lake Tanganyika (Böhm), and the species is distributed in the Belgian Congo and Nyasaland. The radula proves it to belong to Rhachistia.

> Genus Edouardia Gude, 1914 (Faun. India, Moll. ii, p. 280). Type Bulimus conulus Rve.

The complicated history of Gude's genus is as follows. In 1895 \* Martens proposed a new section of Buliminus, which he named Conulinus, to include three new species from Central Africa: ugandae, hildebrandti (= sordidulus), and metula; adding that B. conulus Rve. was related to these forms. In 1897 † he elaborated the matter and nominated conulus as genotype. In 1914 Gude rejected Conulinus Mts. on account of the earlier Conulina Bronn, 1835, substituting for it Edouardia with conulus as genotype. The question was referred to the International Committee on Zoological Nomenclature, who ruled that "Conulinus von Martens stands, with genotype Bulimus conulus Rve."

Tomlin, however, has pointed out that B. B. Woodward had forestalled Martens in designating the type of Conulinus, for in the Zoological Record for 1895, which was published in November 1896, he recorded on p. 59: "Conulinus, n. sect. of Buliminus, Type B. ugandae n. sp. Martens."

There can be no doubt that this prior designation nullifies the ruling of the International Committee, and that Conulinus must be segregated for the group to which ugandae belongs. But this is a highly specialised little group, containing as far as I know only the five species: ugandae Mts., daubenbergeri Dautz. (= percivali Prest. in Ms.), rutshuruensis Pilsb., nyiroensis and carpenteri Conn. apical sculpture shows microspiral engraving and there is a strong blunt keel round the umbilicus, recalling Cerastus rather than the South African and most East African forms more or less akin to conulus, which are almost certainly generically distinct and for which Gude's name Edouardia is available.

Shell small to medium, conical to turriform, perforate, thin, more or less transparent, not strongly sculptured, corneous brown or buff, sometimes with 1 or even 2 spiral bands; suture simple, more or less well defined according to convexity of whorl.

The South African members of this genus are all more or less conoid,

<sup>\*</sup> Nachr.-Bl. D. Mal. Ges., p. 180.

<sup>†</sup> D.O.A., iv, p. 64.

and the generic features cited above will not be stressed in the forthcoming notes unless in the case of some individual departure from them. The entire assemblage can almost be linked up into a smoothly graded chain, but an attempt is here made to divide them into groups in accordance with general size and form. The habit of some species is arboreal and of others subterranean, and the radula in some cases approaches nearest to Rhachistia and in others to Rachis; Peile has examined that of several species in the Gwatkin collection and his notes are included when available. It is remarkable that in most cases the general form of the shell offers no clue as to the habit of the animal, as is borne out in the following note kindly furnished by W. Falcon: "Most of these species in Natal are habitually found on trees and bushes after rain, and many of them (natalensis, carinifera, arenicola, spadicea) spend most of the summer there if they can also find shade and nooks into which to retreat, but in hot weather those on bushes drop to the ground and hide among the dead leaves, and in early spring their coatings of dry mud show that they have hibernated in the soil. Maritzburgensis and dimera I have never found alive on the ground, and I am inclined to think that they usually hibernate under the dead bark of largish trees; at any rate I have found them hibernating there and never anywhere else. Carinifera prefers the crevices of broken rock and stone heaps in the bush, and so does mcbeaniana; of the more eastern species I have no experience."

(i) Rather large, broadly conoid shells, with distinct carination or angulation at the periphery, even in adult specimens; first 2 whorls smooth, remainder sculptured with close, weak, straight, somewhat oblique transverse growth striolae, with spiral lineation, sometimes present on the upper surface, on the base.

Edouardia natalensis (Pfr.). (Pl. xiii, f. 28.) Ref. List No. 321.

1846. Bulimus natalensis Krs., Pfr., Symb., iii, p. 86. D. 1925. Conulinus ,, ,, Conn., Trans. R. Soc. S. Africa, xii, p. 153. N.

Shell rather large, broadly conical on a rounded base, umbilicate, thin, smooth, not very glossy, typically corneous yellow with a narrow peripheral brown band, rarely with a second band above it, but usually unicoloured buff or brown. Spire conical, sides straight, apical angle about 69°, apex acute. Whorls 7, convex, regularly and rapidly increasing, weakly carinate in the type, usually more strongly,

but always somewhat bluntly so, first  $2\frac{1}{2}$  practically smooth, remainder sculptured all over with close, straight, somewhat oblique transverse striolae, a little stronger in occasional lines of growth. Aperture elongate  $\frac{3}{4}$ -lunate, peristome simple, acute, labrum gradually receding in a straight line to the base, columella erect, margin triangularly reflexed, half concealing the narrow umbilicus. A typical specimen from Umkomaas measures

Alt. 19.3, lat. 14.9; apert. alt. 10.9, lat. 8.6; last whorl 15.5 mm.

Hab. NATAL. Near Natal Bay (type, Krauss); Drakensberg (Wahlberg); Umkomaas; Pietermaritzburg; Tongaat; Pinetown; Krantz Kloof (Burnup); Sinkwazi Beach (Puzey).

CAPE PROVINCE. Port Elizabeth; Springfields (Reeve); Kowie (Farquhar); Port St. John's (Shortridge); Knysna (Layard); East London (Longstaff); Mt. Frere (Locke); Somerset East (Mrs. Howard); Fort Brown (Miss Walton).

LORENZO MARQUES. Although there is no reason why this species should not occur here, I omit the records of Rikatla and Delagoa Bay, given in my Reference List, as probably attributable to meridionalis Pfr.

Type in Stuttgart Museum.

The type set of three contains examples of three different species, as now understood—arenicola Bs., natalensis Krs., and what is probably an immature carinifera M. & P.—and it is practically certain from the greater part of Pfeiffer's description and Krauss' figure that the shell Pfeiffer had in hand when describing his species was the solid shiny shell which Benson described later under the name of arenicola; but certain words and omissions in Pfeiffer's description, such as "papyraceous" and omission of the black apex in his type, permit the inference that his description is a composite one, based on at least the two larger of the shells in the type set, and the fact that another tube in the Stuttgart Museum, labelled in his own writing "Buliminus natalensis Krs., Port Natal (Quenzi)," contains a pair of the duller form generally attributed to that species, bears testimony to the author's subsequent conception thereof. A radula, if correctly identified, much resembles that of Rachis, similar in type to that of E. junodi.

> Edouardia spadicea (Pfr.). (Pl. xiii, f. 29, and text-fig. 35.) Ref. List No. 329.

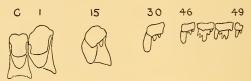
1846. Bulimus spadiceus Mke., Pfr., Symb., iii, p. 87. D. 1854. ,, vitellinus Pfr., P.Z.S., p. 57. D.

A broader, more solid form than *natalensis*, of bright chestnut colour, with rather blunter carination, far wider umbilicus and more oblique aperture. Sides

straight, apical angle 80°. 6 convex whorls, first 2 smooth, remainder sculptured all over with coarse, close, straight transverse striae of somewhat irregular prominence, while the base is closely scored with regular, slightly undulating spiral grooves. Peristome acute, slightly expanded, labrum straight, receding but little, columella erect, margin broadly triangularly reflexed, but not obscuring the rather wide umbilicus.

Alt. 22·0, lat. 19·9; apert. alt. 15·2, lat. 10·3; last whorl 18·0 mm.

Hab. NATAL (vitellinus, coll. Cuming); "In the forests" (spadicea, Krauss); Umlaas River (fide Sturany); Port Shepstone; Durban (Burnup); Illovo R. (Taynton); Umhlali (Rump); Sinkwazi Bush (Puzey).



Text-fig. 35.—Edouardia spadicea (Pfr.), Pietermaritzburg. Teeth from radula; ×300.

CAPE PROVINCE. Somerset East (Miss Bowker); Kentani (Kolbe); Port Elizabeth (Crawford); East London (Power); Port St. John's (Puzey).

TRANSVAAL. Barberton (Cregoe).

Type of spadicea in Stettin, vitellinus in British Museum.

The radula (text-fig. 35) measures  $6 \times 2$  mm., formula  $(56+1+56) \times 145$  formed rows; rhachidian and admedians with broad cusps and no ectocones; a minute ectocone appears in some rows in line 11, thence increasing in size, and is present in all rows in line 15, becoming double in some rows in line 25 and in most by line 29, whence the marginals decrease in size, those at extreme edge being rudimentary. On one side of the radula some of the teeth towards the edge are abnormally irregular, e.g. Nos. 46-49 in text-figure.

In a smaller, perhaps younger, specimen, formula 44+1+44, the ectocone first becomes visible in line 8 and double in line 22.

Edouardia caffra (Pfr.). (Pl. xiii, f. 24–25.) Ref. List No. 329 (pars).

1848. Bulimus spadiceus Mke., var., Krs., Südafr. Moll., p. 79. D. 1848. ,, ,, ,, ,, (Bulimus caffer Krs. in litt.) Pfr., Mon. Hel., ii, p. 192. D.

Differs from all the present group, when mature, in having no peripheral angulation, but apparently best placed here as younger shells are distinctly, though

bluntly, angulate. Corneous brown, sides straight, apical angle 76°; 6½ convex whorls, first 2 smooth, remainder bearing close, weak, straight, somewhat oblique striolae, with no apparent spiral sculpture. Aperture not oblique, about 3 of a circle, labrum straight and receding somewhat in profile, columella erect, slightly concave, margin triangularly reflexed, half covering the umbilious.

Alt. 17.5, lat. 13.0; apert. alt. 8.2, lat. 6.5; last whorl 12.6 mm.

Hab. BECHUANALAND. Mt. Mohapaani, S.W. of Palapve Road Station (Wahlberg).

Type in Stockholm Museum.

Smaller, comparatively narrower and higher than spadicea, differing in its dark brown colour and round whorls from the buff mcbeaniana, smaller and narrower than cockerelli. Krauss mentioned this species, without a name, as a variety of spadicea with round whorls in maturity, and gave its locality and collector, while Pfeiffer gave no locality but alluded to it under *spadicea* as  $\beta$ , minor, fusco-corneus, long. 18, diam. 12 mill., Bulimus caffer Krs. in litt. This may be considered hardly sufficient description, but it identifies the shell, which, in order to avoid adding to synonymy, I think can stand under the name quoted by Pfeiffer, with himself as its author.

> Edouardia carinifera (M. & P.). (Pl. xiii, f. 27.) Ref. List No. 307.

1897. Buliminus (Pachnodus) carinifer M. & P., A.M.N.H., xix, p. 637, pl. xvii, f. 8. D.F.

Differs from the unicoloured brown or yellow forms of natalensis in nothing but the shape of the keel, which may be described as protruding, that part of the whorl immediately above and below it being as though pinched in, so as to give it prominence. The colour is usually chestnut brown, rarely pale yellow, sides straight, apical angle 68°, 7 flattish whorls, the later sculptured, in addition to the usual transverse striolation, with irregular spiral grooves, which become close, regular and prominent on base. Aperture somewhat oblique, much angulate at periphery, peristome simple, columellar margin very narrowly reflexed, but half concealing the very narrow umbilicus. A typical example from Maritzburg

Alt. 19.0, lat. 16.7; apert. alt. 10.5, lat. 8.7; last whorl 13.8 mm.

Hab. NATAL. Gordon Falls, Pietermaritzburg (type, Burnup).

CAPE PROVINCE. Knysna (Purcell); Grahamstown; Bedford; Port Elizabeth (Farquhar); Pirie (Miss Ross); East London (Power); Keurbooms R. bush (Barnard).

ZULULAND. Eshowe (Falcon).

Type in British Museum.

Although the typical form of this species is perfectly distinct from

that of *natalensis* on account of the protruding keel, it is extremely difficult to differentiate between the two when the carination is less well defined, so that it is not certain whether some of the localities assigned to one of them ought not, in reality, to apply to the other; the radula is akin to that of *spadicea*.

#### Edouardia drakensbergensis (Smith).

Ref. List No. 311.

1877. Bulimus (Pachnodus) drakensbergensis Smith, A.M.N.H., xx, p. 538. D.

1922. Edouardia drakensbergensis Smith, Conn., Proc. Mal. Soc., xv, p. 74, pl. ii, f. 6. N.F.

1936. Pachnodus drakensbergensis Smith, Haas, Abh. Senckenb. Ges., No. 431, p. 21. L.

Very slightly less obese than the foregoing, with similar, but slightly less emphasised carination; colour usually dark brown, rarely buff; sculpture as in carinifera. The type pair is immature; my largest example from Shiluwane contains  $6\frac{1}{2}$  nearly flat whorls, apical angle  $66^{\circ}$ , and measures

Alt. 17.0, lat. 13.4; apert. alt. 7.8, lat. 7.4; last whorl 12.2 mm.

Hab. TRANSVAAL. East slope of Drakensberg, near Lydenburg Gold Fields (type, ex Sowerby); Pilgrims Rest (Barrett); Shiluwane District (Junod).

NATAL. Mont aux Sources (Puzey).

LORENZO MARQUES. Delagoa Bay (in Senckenberg Museum, fide Haas).

Type in British Museum.

Apparently an arboreal species, usually covering its shell with a thick layer of powdered bark. It is intermediate between *natalensis* and *carinifera*, rather more slender than the former and less prominently keeled than the latter, perhaps representing the northern form of both species. Haas also records it from Mid-Angola.

#### $Edouardia\ mcbeaniana\ (Bnp.).$

(Pl. xiii, f. 30.)

Ref. List No. 315.

1905. Ena (Pachnodus) mebeaniana Bnp., Proc. Mal. Soc., vi, p. 302, pl. xvi, f. 1-2. D.F.

1922. Edouardia mebeaniana Bnp., Conn., Proc. Mal. Soc., xv, p. 75. L.

Smaller than the foregoing, with nearly vertical aperture; colour bright yellow-buff; sides straight, apical angle  $80^{\circ}$ . Whorls  $6\frac{1}{2}$ , fairly convex, gently angulate

at periphery until nearing the aperture in adult shells, transverse sculpture on all but first 2 whorls of equal strength all over, basal grooving very weak. Aperture nearly circular, peristome simple, columellar margin narrowly reflexed, umbilicus narrow, but quite clear.

Alt. 17.0, lat. 13.8; apert. alt. 9.5, lat. 7.0; last whorl 12.8 mm.

Hab. TRANSVAAL. Pretoria District (type, McBean); Pietpotgietersrust (Connolly); Shiluwane (Junod); Barberton (Déglon).

Type in British Museum.

A species of subterranean habit in daytime, usually retiring far down among large stones in gullies and dry watercourses; the radula approaches that of Rachis.

#### Subspecies lemaneensis Conn.

(Pl. xiii, f. 31.)

1922. Edouardia mcbeaniana Bnp., subsp. lemaneensis Conn., Proc. Mal. Soc., xv, p. 75. D.

Differs from type in smaller diameter, which is only  $11 \cdot 2 \times 10 \cdot 0$  in a shell  $16 \cdot 1$  mm. long, whereas it attains 13.0 × 11.3 mm. in a typical example 15.0 mm. in length; the columellar margin, too, is rather less broadly reflexed and umbilicus more narrow than in the normal form; the apical angle is 67°.

Hab. TRANSVAAL. Lemane, Spelonken District, N. of Pietersburg (Junod).

Type in British Museum.

Edouardia arenicola (Bs.). (Pl. xiii, f. 26, and text-fig. 36.) Ref. List No. 302.

1856. Bulimus arenicola Bs., A.M.N.H., xviii, p. 433.

All examples I have seen are golden buff, typically with, but sometimes without, a rather broad rufous peripheral band. The spire is more slender and comparatively higher than in natalensis or carinifera, apical angle 60°; the peripheral carination well marked until complete maturity, when it becomes less so and the peristome conspicuously expanded, columellar margin very narrowly but almost adnately reflexed, so that the minute umbilious is hardly discernible. A fullsized example from Port Shepstone contains 61 whorls, not very convex and with very little microspiral sculpture, and measures

Alt. 18.5, lat. 12.2; apert. alt. 10.1, lat. 7.4; last whorl 14.2 mm.

Hab. CAPE PROVINCE. Caffraria, near Waterloo Bay (type); "on rushes in the sandhills along the south coast near Mossel Bay" (Layard); Kasouga (Hewitt); Port St. John's (Puzey); East London (Rattray); Oudebosch, River Zonder End Mts. (Barnard); Kaaimans River, George District (Truter).

NATAL. Durban; Pietermaritzburg; Lower Umkomaas; Tongaat; Port Shepstone (Burnup); Illovo R. (Taynton); Sinkwazi Beach (Puzey).

ZULULAND. Dukuduku (Toppin).

Originals in Cambridge Museum.

Radula (text-fig. 36) measures  $4 \times 1.5$  mm., formula  $(46+1+46) \times 115$  formed rows; principally remarkable for broadness of mesocones in all the lines; ectocones absent from rhachidian, but present on admedians, becoming double in some rows in line 20 and in most by line 27; as usual the marginals decrease in size towards the edge of radula. In a small specimen, formula 33+1+33, the ectocone first appears double in line 13 and is double in most rows in line 15.



Text-fig. 36.—Edouardia arenicola (Bs.), Pietermaritzburg. Teeth from radula; ×300.

In regard to the Port Shepstone race (Pl. xi, f. 26), in which the bands are absent and the markings are across the whorls, Falcon writes me that "these are only found at Port Shepstone on a group of trees, chiefly *Erythrina capensis* (Kaffir Boom), in January and February, in large quantities and mostly engaged in copulation. They are larger and more thin-shelled than the ordinary form which is found in the bush all along the coast, and quite deserve a varietal name."

Edouardia meridionalis (Pfr.).

(Pl. xiii, f. 13.)

Ref. List No. 318.

1847. Bulimus meridionalis Pfr., P.Z.S., p. 231. D.

1925. Conulinus " " Conn., Trans. R. Soc. S. Africa, xii, p. 153. L.

Smaller and comparatively more slender than any of the foregoing, apex black, later whorls buff, with, or rarely without, a rufous peripheral band; apical angle 56°, aperture little oblique, periphery only weakly angulate, hardly so at all in the Tembe race. The type contains nearly 7 flattish whorls with very little trace of spiral sculpture, and measures

Alt. 15.6, lat. 10.0; apert. alt. 7.2, lat. 5.1; last whorl 10.7 mm.

Hab. SOUTH AFRICA (type in coll. Cuming).

CAPE PROVINCE. Port Elizabeth (Crawford; Farquhar); East London (Rattray).

LORENZO MARQUES. Matolla (Penther); Tembe; Magude; Morakwen; gardens in Lorenzo Marques (Junod).

Type in British Museum.

The radula resembles that of arenicola.

Edouardia dimera (M. & P.). (Pl. xiii, f. 18.) Ref. List No. 310.

1901. Buliminus (Rhachis) dimerus M. & P., A.M.N.H., viii, p. 320, pl. ii, f. 13. D.F.

Rather smaller than meridionalis, from which it is easily distinguishable by its colour scheme, the upper half of each whorl being dark or bright chestnut and the lower buff, while the last 3 whorls and base are sculptured with strong, close, continuous spiral lines, visible under a hand-lens, thus differing from all South African members of the genus. Whorls  $6\frac{1}{4}$ , apical angle  $57^{\circ}$ , aperture a little oblique, columellar margin more broadly reflexed than in the last two species. Alt. 13-0, lat. 8-7; apert. alt. 6-7, lat. 4-7; last whorl 9-5 mm.

Hab. NATAL. Karkloof Bush (type, McBean); Bulwer (Warren); Krantzkop (Falcon); Balgowan (Pennington); Durban Bluff (Puzey). CAPE PROVINCE. King Williamstown (Godfrey).

Type in British Museum.

The Durban race is noticeably narrower than type, about  $13 \times 8$  mm. in height and breadth, but typical in other respects, including spiral sculpture.

(ii) Shell small to medium, spire equilateral to acutely triangular, with periphery in all stages of growth usually well rounded; smooth and glossy, uniform corneous brown or buff, no banded varieties yet recorded.

Edouardia cockerelli (Pilsb.). (Pl. xiii, f. 33.)

1933. Conulinus cockerelli Pilsb., Nautilus, xlvi, p. 101, pl. vi, f. 7. D.F.

Founded on two specimens, of which the larger, selected as type, is too weathered to show its original colour, but the smaller is pale yellow; the type is narrower than spadicea, higher than mcbeaniana, broader than maritzburgensis, and differs from natalensis and all others of similar size in complete absence of peripheral angulation, though this feature is present in the immature example. The type has 7 whorls, apical angle 78°, and measures

Alt. 20.5, lat. 15.5; apert. alt. 10.9, lat. 8.2; last whorl 15.2 mm.

Hab. NATAL. The Bluff, Durban (Cockerell). Type in Academy of Natural Sciences, Philadelphia. Differs from *natalensis* only in the absence of peripheral angulation; the discrepancies between Pilsbry's measurements of the aperture and mine are merely due to his taking the outer and myself the inner margins as our limits, and is of no serious importance, once this difference in mensuration is realised.

#### Edouardia junodi Conn.

(Pl. xi, f. 17.)

1922. Edouardia junodi Conn., A.M.N.H., x, p. 120. D.

1925. Conulinus ,, ,, Trans. R. Soc. S. Africa, xii, p. 154, pl. iv, f. 18; pl. viii, f. 5–7. A.R.F.

Shell rather small, broadly conoid, umbilicate, yellowish corneous. Spire with straight sides, apical angle 80°, apex mamillate. Whorls 5, very convex, with only the faintest appearance of angulation, sculptured with faint, close, regular, transverse striae.

Alt. 10.8, lat. 10.2; apert. alt. 6.6, lat. 5.0; last whorl 8.5 mm.

Hab. LORENZO MARQUES. Lebombo Mountains (Junod). Type in Kimberley Museum.

The anatomy of this species was discussed at length by Watson in 1925 ( $v.\ supra$ ), and said to be of the same type as that of such other South African species of the genus as had been dissected; the shell is nearly related to mcbeaniana, which it resembles in its subterranean habit, but its whorls are more tumid and more rounded at the periphery, with slightly more open umbilicus. The radula has tricuspid central, bicuspid laterals, lacking an endocone, and marginals for the most part tricuspid, owing to the small ectocone being split in two; formula of two specimens  $(21+14+1+14+23) \times 145$  and  $(21+14+1+14+21) \times 140$ .

#### Edouardia maritzburgensis (M. & P.).

(Pl. xiii, f. 32.)

Ref. List No. 316.

1893. Buliminus (Pachnodus) maritzburgensis M. & P., A.M.N.H., xii, p. 105, pl. iii, f. 5. D.F.

Shell comparatively narrower than that of the two foregoing, sides straight, apical angle 55°. Whorls 7, convex, last 5 sculptured with slightly curved, oblique striolae, and patchy microspiral grooving on lower parts of 6th and 7th whorls. Aperture vertical, suboval, peristome simple, labrum straight and hardly receding in profile, columella erect, margin narrowly reflexed, but nearly concealing the narrow umbilicus.

Alt. 16.4, lat. 10.2; apert. alt. 8.1, lat. 5.5; last whorl 11.7 mm.

Hab. NATAL. Thornybush (Uisidoorn) and other localities round Pietermaritzburg (type); Ladysmith (Burnup); Nel's Rust (Akerman); Weenen (Mullins).

Type in British Museum.

An arboreal species, clustering on bark of trees and coated with its dust; it is only most rarely that there is any appearance of peripheral carination; the radula is of the *Rachis* type. Races from Bushman's R., Weenen (Thomasset), and Mfongosi (Jones) which closely resemble this species are considered by Watson anatomically distinct.

Edouardia conulus (Rve.). (Pl. xiii, f. 22.) Ref. List No. 308.

1849. Bulimus conulus Rve., Conch. Icon., pl. lxxviii, f. 577. D.F. 1925. Conulinus conulus Rve., Conn., Trans. R. Soc. S. Africa, xii, p. 153. N.

Similar to foregoing in every respect except for having less convex whorls and consequently narrower aperture, while complete absence of peripheral angulation distinguishes it from *meridionalis*. The weathered type was apparently uniform brown when in fresh condition; it contains 7 flattish whorls, apical angle 63°, and measures

Alt. 15.2, lat. 9.0; apert. alt. 7.3, lat. 4.6; last whorl 11.0 mm.

Hab. NATAL. Port Natal (type, Mus. Cuming); Port Shepstone (Cawston).

ZULULAND. Makowe (Crosly); Umhlatusi; Eshowe; False and St. Lucia Bays (Bell Marley).

Type in British Museum.

Edouardia burnupi (M. & P.). (Pl. xiii, f. 21.) Ref. List No. 306.

1903. Buliminus (Pachnodus) burnupi M. & P., A.M.N.H., xii, p. 605, pl. xxxi, f. 5. D.F.

A large form nearest conulus in shape, but too long defunct for accurate deduction as to its texture or coloration. Sides straight, apical angle 56°. Whorls 8, moderately convex, rounded at periphery, with faint transverse, but no remaining trace of spiral sculpture. Aperture suboval, labrum straight, receding somewhat in profile, columella erect, margin narrowly reflexed, more than half concealing the narrow umbilicus.

Alt. 15·4, lat. 9·1; apert. alt. 7·7, lat. 4·3; last whorl 11·6 mm.

Hab. ZULULAND. Lower Umfolosi Drift (Burnup). Type in British Museum.

The radula in the Gwatkin collection, if properly identified, is of the *Rachis* type.

It is obvious from a glance at the figures that conulus and burnupi are probably but one and the same species, and I have little doubt that this will prove to be the case when further material in quantity comes to hand, pending which it may be preferable to retain distinction between them.

#### Edouardia tumida (Taylor).

(Pl. xiii, f. 9.)

1869. Buliminus (Pachnodus) conulus Rve., Mts., Nachr.-Bl. D. Mal. Ges., i, p. 153. N.

1877. Buliminus tumidus Gibbons, Taylor, Q.J.C., i, p. 254, pl. ii, f. 4. D.F.

1897. Buliminus (Conulinus) tumidus Gibb., Mts., D.O.A., iv, p. 65. N.

1901. Buliminus (Conulinus) tumidus Gibb, Kob., Conch. Cab., p. 796, pl. cxvii, f. 8-9. D.F.

1925. Conulinus tumidus Gibb., Conn., Trans. R. Soc. S. Africa, xii, p. 153, pl. iv, f. 20. N.F.

Smaller than the foregoing, but with less narrow umbilicus; corneous brown, straight sides, apical angle  $64^{\circ}$ ; whorls  $7\frac{1}{2}$ , convex, first  $2\frac{1}{2}$  smooth, last 5 slightly more crisply striolate than in the last four species, with no apparent spiral sculpture. Aperture vertical, suboval, columella erect, margin rather broadly reflexed.

Alt. 12.1, lat. 7.3; apert. alt. 5.5, lat. 3.0; last whorl 8.5 mm.

Hab. LORENZO MARQUES. Mtisherra R. Valley (Cressy).

Described from Zanzibar and distributed near the coast from Kenya southwards, and varying a little in form even in the same series. The whereabouts of the type is doubtful, but Taylor identified the shell now described as typical of his species.

# Edouardia sordidula (Mts.).

(Pl. xiii, f. 10.)

1878. Buliminus (Rhachis) conulinus Mts., Monatsb. Akad. Wiss. Berlin, p. 294. N.

1895. Buliminus (Conulinus) hildebrandti Mts., Nachr.-Bl. D. Mal. Ges., xxvii, p. 180. D.

1897. Buliminus (Conulinus) sordidulus (= hildebrandti Mts., 1895, non 1878) Mts., D.O.A., p. 65, pl. iii, f. 30. D.F.

1901. Buliminus (Conulinus) sordidulus Mts., Kob., Conch. Cab., p. 801, pl. exvii, f. 17. D.F.

1910. Buliminus (Conulinus) sordidulus Mts., d'Ailly, Kilimandjaro, i, 6, p. 18. D.

1925. Conulinus sordidulus Mts., Conn., Trans. R. Soc. S. Africa, xii, p. 154, pl. iv, f. 19. N.F.

Shell small, conical, narrowly umbilicate, thin, smooth, glossy, translucent, corneous brown. Spire produced, sides regular, apical angle 46°, apex acute. Whorls 62, flattish, regularly increasing, first 12 smoothly micropunctate, remainder covered with faint, moderately close and regular, oblique transverse striae parallel to the lines of growth; suture simple, well defined. Aperture suboval, peristome simple, acute, labrum straight in profile, receding a little to the base, columella erect, margin white, rather narrowly triangularly reflexed, half concealing the narrow umbilicus; callus none.

Long. 10·3, lat. 5·2; apert. alt. 4·5, lat. 2·5; last whorl 6·5 mm.

Hab. LORENZO MARQUES. Wanetsi River, Majude District (Bell Marley).

ZULULAND. Ubombo (Bell Marley).

Type in Berlin Museum; shell described, from Wanetsi R., in Natal Museum.

A Central African species originally described from Kenya Colony and recorded from Tanganyika Territory; it is much more smooth and narrow than the last, but has the same comparatively crisp transverse striolation.

South African examples have infinitesimally less convex whorls than those treated as typical by Martens and d'Ailly, and may be referable to an immature singleton from L. Jipe, somewhat doubtfully assigned to this species by the former in 1897, but the difference in the shell appears to my mind too nearly imperceptible to merit varietal distinction.

Edouardia metuloides (Smith).

(Pl. xiii, f. 16.)

Ref. List No. 319.

1899. Buliminus (Conulinus) metuloides Smith, P.Z.S., p. 587, pl. xxxiii, f. 43. D.F.

1925. Conulinus metuloides Smith, Conn., Trans. R. Soc. S. Africa, xii, p. 154. L.

Differs from sordidula in having more convex whorls, of which there are  $7\frac{1}{2}$ , convex, sculptured as in the last, apical angle 47°. Aperture nearly circular, labrum receding considerably, columellar margin narrowly reflexed, but almost concealing the narrow umbilicus.

Alt. 12.5, lat. 6.6; apert. alt. 5.2, lat. 3.4; last whorl 7.7 mm.

Hab. LORENZO MARQUES. Mtisherra R. Valley (Cressy). S. RHODESIA. Victoria Falls (Becker; Connolly). 28 VOL. XXXIII.

Described from Zomba, Nyasaland, and recently collected at Broken Hill, N. Rhodesia.

Type in British Museum.

The race from Mtisherra Valley is entirely typical, but those from S. Rhodesia yet examined are extremely slightly more obese than type, though quite inseparable.

The radula is of the same type as in junodi.

# Edouardia transvaalensis (M. & P.).

(Pl. xiii, f. 11.)

Ref. List No. 333.

1893. Buliminus transvaalensis M. & P., A.M.N.H., xii, p. 105, pl. iii, f. 6. D.F.

1922. Edouardia transvaalensis M. & P., Conn., Proc. Mal. Soc., xv, p. 75. N.L.

1925. Conulinus transvaalensis M. & P., Conn., Trans. R. Soc. S. Africa, xii, p. 154. L.

Nearly the smallest of the genus. Whorls 6, not very convex, apical angle 47°, striolae on last 4 whorls weak except below suture, without spiral lineation. Aperture quadrate, with rounded base and labrum, columella straight, erect, margin rather broadly reflexed, umbilicus very narrow.

Alt. 7.8, lat. 4.3; apert. alt. 3.5, lat. 2.0; last whorl 5.2 mm.

Hab. NORTHERN TRANSVAAL (type, Bowker); Elim (Junod). LORENZO MARQUES. Lebombo Mountains (Junod).

Type in British Museum.

Another arboreal species, usually coated with bark dust; its distribution appears to extend into Kenya and the Belgian Congo.

# Edouardia kaokoensis (Conn.).

(Pl. xiii, f. 23.)

1929. Conulinus kaokoensis Conn., Ann. Natal Mus., vi, p. 231, pl. xiv, f. 24. D.F.

Shell of fair size, conoid, narrowly umbilicate, probably corneous brown. Sides regular, apical angle ca.  $65^{\circ}$ , apex submamillate. Whorls 6, moderately convex, rounded at periphery, first  $2\frac{1}{2}$  practically smooth, remainder sculptured with faint, close, oblique transverse striolae, which are more or less interrupted on the last 2 by irregular microspiral grooves; suture well defined. Aperture subovate, extremities close together, peristome narrowly expanded, acute, labrum receding but little, columella erect, margin triangularly reflexed, umbilicus narrow, but deep.

Alt. 18·8, lat. 13·2; apert. alt. 10·0, lat. 8·0; last whorl 14·4 mm.

Hab. KAOKOVELD. Hoarusib River, near Kaoko Otavi (Barnard). Type in South African Museum.

# Edouardia (?) zuluensis (M. & P.). (Pl. xiii, f. 20.)

Ref. List No. 334.

1898. Buliminus zuluensis M. & P., A.M.N.H., ii, p. 127, pl. vii, f. 5. D.F.

Shell of good size, turriform, perforate, solid, subcalcareous, smooth, glossy, milky white. Spire produced, sides regular, apical angle 54°. Whorls 7, moderately convex, regularly increasing, practically destitute of sculpture, except for irregular pitting on the earlier and some weak growth lines on the later whorls; suture simple, well defined. Aperture \(\frac{3}{4}\)-oval, peristome simple, labrum vertical in profile, slightly recurved for a short distance below the suture, columella erect, slightly concave, margin triangularly reflexed, partly concealing the narrow umbilicus.

Alt. 21.9, lat. 10.1; apert. alt. 9.3, lat. 4.2; last whorl 14.1 mm.

Hab. ZULULAND. Inseyi River (fide M. & P.). Type in British Museum.

It is impossible to estimate from the unique type its age or the degree of calcination which it has undergone.

### Genus Rachis Albers, 1850

(= Rhachis auctt. and Rachisellus Bgt., 1889).

Type Bulimus punctatus Anton (férussaci Dkr.).

Shell comparatively small, turriform, narrowly umbilicate, smooth, buff or cream with irregular black dots and usually a narrow brown peripheral band, peristome simple, acute, apex unsculptured. Radula with outer cusps on central and laterals, about 20 marginals with 2-4 small outer cusps.

# Rachis punctata (Anton). (Pl. xiii, f. 1.) Ref. List No. 327.

1839. Bulimus punctatus Ant., Verz. Conch. Samml., p. 42. D.

férussaci Dkr., Zeitschr. f. Mal., ii, p. 164. D. 1845.

" Novit. Conch., Suppl. ii, p. 6, pl. i, 1853. f. 35-36. D.F.

1889. Rachisellus ledoulxi Bgt., Moll. Afr. équat., p. 70, pl. v, f. 10-11. D.F.

1914. Rachisellus punctatus Ant., Gude, Faun. India, Moll. ii, p. 277. D.

1919. Rachis punctatus Ant., Pilsb., Bull. Amer. Mus., xl, p. 304. D.

1925. Rhachis punctata Ant. (=férussaci Dkr.), Conn., Trans. R. Soc. S. Africa, xii, p. 160, pl. iv, f. 22. N.F.

1930. Rachis punctata Ant., Conn., Ann. S.A. Mus., xxix, p. 290. N. 1932. Rachisellus punctatus Ant., Seshaiya, Annamalai Univ. J., i, p. 72. A.R.

Shell rather small, short turriform, umbilicate, thin, smooth, rather dull, cream with nearly vertical streaks, varying in breadth, of pale chestnut and numerous irregular dark brown dots, and a rather narrow dark band just below the periphery, rarely so faint and narrow as to be almost invisible. Spire produced, sides straight, apex narrowly rounded, angle ca. 45°. Whorls  $7\frac{1}{2}$ , not very convex, angulate at periphery of young shells, regularly increasing, first 2 smooth, remainder sculptured with extremely fine, faint and close, straight, nearly vertical striolae, and, in fresh condition, equally fine and close microspiral lineation; suture shallow. Aperture vertical, subovate, labrum straight and receding but little in profile, columella straight, erect, margin very narrowly reflexed over the narrow umbilicus. Alt. 16·3, lat. 6·9; apert. alt. 7·0, lat. 3·5; last whorl 10·3 mm.

Hab. LORENZO MARQUES. Tette (Peters).

Also recorded by Sturany from Ovamboland and Upingtonia,\* which I pointed out in 1930 are improbable localities for this arboreal species, and more likely referable to some form of *Xerocerastus*.

Radula formula (15 to 10 or 11+1+10 or 11 to  $15) \times 105$ , central tooth with large middle cusp and a minute one on each side, laterals with prominent endocone and smaller blunt ectocone, inner marginals with prominent endocone and usually 3-5 small outer cusps, outer marginals very small and usually devoid of cusps.

Rachis jejuna (M. & P.). (Pl. xiii, f. 2.) Ref. List No. 327 (pars).

1893. Buliminus (Pachnodus) jejunus M. & P., A.M.N.H., xii, p. 106, pl. iii, f. 7. D.F.

1925. Rhachis jejuna M. & P., Conn., Trans. R. Soc. S. Africa, xii, p. 160, pl. iv, f. 21. N.F.

Differs from punctata through rather flatter, more rapidly increasing whorls, and, consequently, longer and narrower aperture; creamy white, with fewer spots than punctata and occasional narrow rufous transverse strigae, but very seldom with peripheral band. The largest specimen examined contains  $7\frac{1}{2}$  nearly flat whorls and measures

Alt. 18·4, lat. 8·1; apert. alt. 7·1, lat. 3·7; last whorl  $11\cdot7$  mm., while that figured, with 7 whorls, is alt.  $16\cdot4$ , lat.  $6\cdot9$ ; apert. alt.  $7\cdot0$ , lat.  $3\cdot6$ ; last whorl  $11\cdot0$  mm.

Hab. NORTHERN TRANSVAAL (type, Bowker); Komati Poort (Newington).

\* Upingtonia is equivalent to northern Damaraland; it was declared a Republic by W. Jordan in 1885 and ceased to exist as such after he was murdered in 1886. LORENZO MARQUES. Lebombo Mountains, under bark of dead tree (Junod); Wanetsi River, Majude District (Bell Marley).

ZULULAND. Banks of R. Pongola (Bell Marley).

S. RHODESIA. Near Gwelo (Dodds).

Type in British Museum.

The type set of this species consists of immature examples, whose close resemblance to *punctata* at the same stage of growth caused me to unite them, but now that mature shells have come to hand in quantity they prove to be abundantly distinct.

Section Pleurorhachis n. Type Bulimus petersi Pfr.

Shell similar in appearance to *Rachis*, but apical whorls sculptured with strong, distant, radial ribs (text-fig. 37).

Rachis petersi (Pfr.).
(Pl. xiii, f. 15, and text-fig. 37.)
Ref. List No. 325.

1855. Bulimus petersi Pfr., P.Z.S., p. 97. D.

1925. Rhachis petersi Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 160. N.F.

Shell small, acuminate ovate, umbilicate, fairly solid, moderately smooth and glossy, first 3 whorls brown, later cream, with narrow brown streaks about as

broad as the intervals between them. Spire produced, sides very slightly convex, apex acute, angle 57°. Whorls 6½, moderately convex, first 2 sculptured to extreme apex with strong, straight, nearly equidistant radial costae, 43 in number to end of 2nd whorl, where they cease abruptly, remainder bearing close, fairly regular, rather coarse, straight, nearly vertical striae, weaker on last whorl, with signs of microspiral dotted lines about the 4th, but not clear enough for exact determination; suture simple, well defined. Aperture vertical, suboval, peristome simple, labrum straight and receding slightly in profile, columella erect, margin triangularly reflexed, partly overhanging the comparatively wide umbilicus.

Alt.  $12\cdot0$ , lat.  $6\cdot2$ ; apert. alt.  $5\cdot5$ , lat.  $2\cdot7$ ; last whorl  $8\cdot3$  mm.

Hab. LORENZO MARQUES. Tette (Peters).

Type in British Museum.



Text-fig. 37.—Rachis (Pleurorhachis) petersi (Pfr.), type. Apical sculpture; ×6.

#### Genus Limicena Conn., 1925

(Trans. R. Soc. S. Africa, xii, p. 169, and Thiele, Handb. Syst. Weicht., ii, 1931, p. 524).

Type Buliminus (Conulinus) nyasanus Smith.

Shell large, bulimoid when adult, perforate, columella not truncate, protoconch ( $2\frac{1}{2}$  whorls) bearing 8 or 9 strong spiral costae, remainder weakly transversely striate.

Thiele has placed *Limicena* as a subgenus under *Conulinus* (*Edouardia*), but the large shell, which bears far greater resemblance to *Limicolaria*, and strong spiral costation of the protoconch, appear to merit for it full generic status.

# Limicena nyasana (Smith). (Text-fig. 38, A, B.)

1899. Buliminus (Conulinus) nyasanus Smith, P.Z.S., p. 586, pl. xxxiii, f. 41–42. D.F.

1911. Buliminus nyasanus Smith, Thiele, Deutsch. Zent.-Afr.-Exp., p. 202. R.

1925. Limicena nyasana Smith, Conn., Trans. R. Soc. S. Africa, xii, p. 170. N.

Shell large, bulimoid, umbilicate, thin, smooth, rather dull, pale corneous brown. Spire produced, sides nearly straight, apical angle 68°, extreme summit square, apex involute. Whorls 6, convex, rapidly increasing, first  $\frac{1}{2}$  whorl curling below the level of the next, so that the summit is rectilinear, first  $2\frac{1}{2}$  bearing very strong, fine, equidistant spiral ridges, increasing from 6 at apex to 12 on 2nd whorl, the interstices between them crossed by rather distant, short, oblique costulae; remainder sculptured only with fine, close, regular, oblique straige; suture simple, well defined. Aperture ovate, peristome simple, acute, labrum straight and receding somewhat in profile, columella straight and erect, margin broadly triangularly reflexed.

My figure is that of a badly damaged shell, the dotted lines representing its approximate reconstruction, which is larger than the type and gives a better idea of its mature form: alt. 26·0, lat. ca. 11·0; apert. alt. 10·0, lat. ca. 5·5; last whorl 21·4 mm., but a still larger specimen, which I gathered for an all too brief moment before it fell down an unfathomable crevasse in Palm Kloof, was probably half an inch longer and had all the appearance of a *Limicolaria*, whence is derived the compound generic name.

Hab. LORENZO MARQUES. Mtisherra R. Valley (Cressy). Type in British Museum.

Described from Nyasaland and collected by myself in Palm Kloof, north bank of the Zambesi at Victoria Falls, but not on the southern

side. Neuville and Anthony have recorded this species from Abyssinia, but it appears hardly possible that their identification can be correct.

The clear, strong spiral sculpture of the protoconch, changing abruptly into weaker transverse striation on the later whorls, is only comparable among the larger African species with that of *Krapfiella* Preston, but *Krapfiella* has a broad apex and an elongate shell, while *Limicena* has a narrow apex and a bulimoid shell. Newly hatched specimens of this species crawl about the superficial rocks in Palm Kloof in large numbers, in contrast to the burrowing habits of their parents, and may easily be mistaken at first glance for a small form of *Ligatella*.



Text-fig. 38.—Limicena nyasana (Smith), Palm Kloof, Victoria Falls.

A. Reconstructed shell, actual size; the dotted lines represent probable contour.

B. Apical sculpture, highly magnified.

#### TRIBE ELASMOGNATHA.

Jaw with broad median projection extending backwards from its upper part.

#### FAMILY SUCCINEIDAE H. G. Bellars, 1858

(Ill. Cat. Brit. Land and Freshwater Shells, p. 20).

Although I have not repeated in the present work the references to family authorship given in my Reference List, that cited above antedates by so many years previous claim to the establishment of this family on a distinct footing that it appears to deserve special mention.

Apart from a few forms which have more degenerate shells and do not occur in South Africa, all the members of this family are commonly placed in the genus *Succinea*, which is sufficiently treated below.

Genus Succinea Drap., 1801 (Tabl. Moll. Fr., p. 32).

Type S. amphibia Drap. (putris Lin.).

Shell ovate, horn-coloured or amber, not umbilicate, spire usually short, body whorl large, whorls 4 or less, peristome thin, epidermis slightly wrinkled in lines of growth.

Animal large for size of shell; sole tripartite; upper tentacles swollen at base, lower feebly developed. No caudal mucous gland or shell lobes; right body lobe divided at anterior end by a faecal groove, left not divided and extending to posterior end of collar.

Jaw elasmognathous, usually with median projection; central tooth of radula with mesocone and usually a small ectocone on each side, laterals with mesocone and ectocone, marginals with single mesocone, usually an endocone, and ectocones split into from 2 to 4 or 5 points; basal plates of marginals sometimes short and sometimes narrow and elongate.

Kidney heterurethrous; buccal mass incapable of withdrawal through the narrow oesophageal nerve ring; stomach with a small pyloric caecum. Ovotestis compact; central portion of hermaphrodite duct often intensely black, swollen and twisted; two seminal vesicles; vagina varying in length, so that the slender duct of the globular spermatheca is inserted at a point more or less distant from the atrium. Prostate a compact oval or kidney-shaped organ; vas deferens varying greatly in length. Epiphallus and small penial appendix sometimes present and included in a backward prolongation of the penis sheath. Male and female orifices open together into a very short atrium, visible as a slit below and behind base of right tentacle.

The normal habitat of this genus is semi-aquatic.

Succinea africana Krs.

(Pl. xv, f. 1–2.)

Ref. List No. 455.

1848. Succinea amphibia Drap., var. africana Krs., Südafr. Moll., p. 73. N.

1856. Succinea africana Krs., Bgt., Rev. et Mag. Zool., p. 11. N.

Shell large, acuminate oval, imperforate, fairly smooth and glossy, thin, transparent, corneous amber. Spire moderately produced, apex mamillate. Whorls 3, convex, rapidly increasing, 1st minute, smooth, remainder bearing weak, straight, very slightly oblique striae, becoming close, regular and stronger on last whorl, which is rough to the touch; suture well defined. Aperture large, suboval, labrum straight and receding slightly in profile, columella erect, scarcely thickened toward upper extremity. A well-grown paratype measures

Alt. 15.9, lat. maj. 8.9; apert. alt. 11.2, lat. 6.7; last whorl 14.5 mm.

Hab. TRANSVAAL. River Limpopo (Wahlberg); Krüger Park (Haas).

S. RHODESIA. Victoria Falls (Connolly).

Type in Stuttgart Museum.

The paratype described above is shorter in spire and longer in aperture than badia Morel., its nearest ally, and comparatively narrower than striata. Krauss, while finding no valid reason for separating it specifically from German examples of amphibia Drap. (putris Lin.), says that the aperture is a little narrower above, and the last whorl, opposite the labrum, more swollen, which recent comparison proves to be the case. It is of course hazardous to base the conception of any species in such a genus as Succinea on a single shell, but in any case the oldest names available for South or even Central African species are those published by Krauss, which renders it advisable to employ them as pegs on which to hang similar forms of more recent description.

The actual type is a far younger, smaller shell, which agrees entirely with my Rhodesian specimens and bears close resemblance to dakaensis Stur.

#### Succinea striata Krs.

### (Pl. xv, f. 3-4.)

Ref. List Nos. 457, 465, 466.

1848. Succinea striata Krs., Südafr. Moll., p. 73, pl. iv, f. 16. D.F. 1856. , planti Pfr., P.Z.S., p. 326. D.

1893. ,, bowkeri M. & P., A.M.N.H., xii, p. 110, pl. iii, f. 18. D.F.

1922. Succinea planti Pfr., Dup. & Putz., Ann. Soc. Zool. Belg., pp. 71, 72, f. 5.  $\,N.F.$ 

1922. Succinea striata Krs., Dgnr., L.-u S.-w. Fauna D.-Sw. A., Moll., p. 40. N.

1925. Succinea striata Krs. (= planti Pfr.), Conn., Trans. R. Soc. S. Africa, xii, p. 186. N.

1930. Succinea striata Krs., Conn., Ann. S.A. Mus., xxix, p. 308. N. 1936. ,, ,, ,, Quick, Ann. Natal Mus. viii, pp. 22, 23, 34, pl. ii, f. 6; pl. iii, f, 3–5; pl. iv, f. 7. D.F.A.R.\*

1936. Succinea planti Pfr., Quick, ibid., pp. 23, 36. D.F.A.R.

Shell of fair size, ventricose ovate, slightly silky, pale amber. Spire very short, apex mamillate. Whorls 3, 1st minute, 2nd very convex, 1st practically smooth, remainder covered with close, fine, straight, slightly oblique striae, varying somewhat in strength, while the surface is more or less shagreened, without, however, any noticeable spiral sculpture; suture well defined. Aperture large,

<sup>\*</sup> Quick's valuable paper appeared too late for its contents to be quoted in the present work, but I may mention that the author agrees with me in subordinating S. planti Pfr. to striata Krs.

ovate, labrum straight and receding slightly in profile, base broadly rounded, columella erect, slightly concave. A well-grown Maritzburg example measures Alt. 12·0, lat. 8·0; apert. alt. 7·8, lat. 5·6; last whorl 10·6 mm.

Hab. TRANSVAAL. R. Limpopo (striata, Wahlberg); Pretoria (McBean); Rustenburg (in Albany Museum); Krüger Park (Haas).

NATAL. Pietermaritzburg (Burnup); Malvern (bowkeri, Bowker); Cape Natal (planti, Plant); Balgowan (Pennington); Illovo Lagoon (Cawston).

ZULULAND. Mazimba Hill (Haas).

CAPE PROVINCE. East London (Swan); Dronfield (Williams); 7-fountains, Albany District (Rennie); Grahamstown (Farquhar); Zuurberg (Crawford).

ORANGE FREE STATE. Kopjes Siding (Connolly); Bloemfontein (Godfrey).

S. RHODESIA. Bulawayo (Connolly).

LORENZO MARQUES. Lebombo Mts. (Junod); Lake Zandemela (Lawrence).

BECHUANALAND. Vryburg (Phear).

BASUTOLAND. Masite (Hewitt).

DAMARALAND. Gobabis (subfossil, Hermann); Okahandja (Michaelsen).

Type of *striata* in Stuttgart, *planti* and *bowkeri* in British Museum. The type, by no means full grown, is remarkable for unusually strong growth wrinkles, but the second of the type pair, much younger, is only normal in this respect.

Succinea in many parts of Africa adopts an almost purely terrestrial habit, infesting scrub in the dry bushveld which never becomes swampy even in the rare event of heavy rain. Under these conditions it seldom attains normal proportions, but remains of stunted growth, although a better grown individual occasionally occurs to illustrate the normal form of the race. Planti merely represents one of these dwarfed races of striata, of which bowkeri is only a well-developed example, and I have Tomlin's full concurrence in uniting them. The Damara localities above may perhaps be based on S. badia.

var. piscinalis M. & P. Ref. List No. 464.

1898. Succinea piscinalis M. & P., A.M.N.H., ii, p. 127, pl. vii, f. 4. D.F.

Narrower than type, with more exserted spire, which emphasises the narrow appearance. In other respects the shell agrees with *striata*, in company with which

it occurs at Fish River, the type locality, and Kopjes. It bears closer resemblance to *badia* than to *striata*, but its conjunction with the last leads me to regard it as a variety thereof rather than a close ally of Morelet's species. The type, with 3 convex whorls, measures

Alt. 12.0, lat. 6.7; apert. alt. 8.2, lat. 5.0; last whorl 10.3 mm.

Hab. CAPE PROVINCE. Fish R., Cradock (type, Farquhar); Mossel Bay (Power).

ORANGE FREE STATE. Kopjes Siding (Connolly).

Type in British Museum.

# Succinea badia Morel.

(Pl. xv, f. 10.)

Ref. List No. 462 (as moussoni).

1868. Succinea badia Morel., Voy. Welwitsch, p. 54, pl. i, f. 4. D.F.

1869. ,, ,, Mts., Mal. Blätt., xvi, p. 210. D.

1904. ,, moussoni Mts., Die Kalahari, p. 755, f. 2. D.F.

1930. , badia Morel., Conn., Ann. S.A. Mus., xxix, p. 307. N.

A large species, far more slender than *striata*, with a much longer spire and similar, though perhaps very slightly weaker sculpture; there are 3 convex, very rapidly increasing whorls, and the aperture is comparatively narrow and base less broadened. The type, which is about average size, measures

Alt. 13·4, lat.  $7\cdot 9$ ; apert. alt. 8·4, lat.  $4\cdot 5$ ; last whorl  $11\cdot 2$  mm., while a larger example from Kaoko Otavi is alt.  $16\cdot 5$ , lat.  $8\cdot 9$ ; apert. alt.  $9\cdot 6$ , lat.  $5\cdot 6$ ; last whorl

14.0 mm.

Hab. GREAT NAMAQUALAND. Bullspoort (Tucker).

DAMARALAND. Homeib R., near Klip (Siegmann); Sandfontein (Drury).

KAOKOVELD. Ombombo; Kaoko Otavi (Barnard).

GRIQUALAND WEST. Excelsior, Modder River (Swan).

OVAMBOLAND. Upingtonia, S.E. of Ondonga (moussoni, subfossil, Schinz); Sodanna (moussoni, Passarge).

BRITISH BECHUANALAND. South of Hardekol Drift, Botletle R. (moussoni, Passarge).

ORANGE FREE STATE. Jacobsdal (Swan).

Described from Calemba Is., Angola.

Type of badia in British, moussoni in Berlin Museum.

Occurs in large numbers in flat open valleys in the Kaokoveld, which are only flooded occasionally in the summer; in the dry season the animals hide in the ground under logs or at the roots of grass.

Martens records badia from Abyssinia, though it must be doubtful whether such distribution can be correct.

The localities for moussoni are in the same latitude as those for

badia in the Kaokoveld, and the figure of the former has the same contour as the latter; nothing in Martens' description indicates distinction between the two species, and I think it may be safely assumed that moussoni is merely an immature form of badia, which was not known to occur in South Africa when moussoni was described. The latter measures: alt. 9, lat. 4.6; apert. alt. 6, lat. 3.5 mm.

var. praelonga nov.

(Text-fig. 39.)

Shell comparatively large, imperforate, much elongate acuminate ovate, sub-fossil. Spire produced, apex submamillate. Whorls 4, fairly convex, rapidly



Text-fig. 39.—Succinea badia Morel., var. praelonga Conn., Taungs.

Type on left; natural size.

increasing, 1st smooth, remainder bearing strong, straight, slightly oblique growth striae; suture well defined. Aperture acuminate ovate, labrum straight and receding a little in profile, columella long, inclined inwards, in the type and majority of examples a little thickened, very slightly twisted just before joining the paries.

Alt. 16.5, lat. 7.8; apert. alt. 9.4, lat. 5.2; last whorl 14.0 mm.

Hab. BECHUANALAND. Taungs (P. D. van Tonder).

Type in British Museum.

The type is selected as representing the prevalent form and size of this variable race, but the largest example measures alt. 18.5, lat. 8.2; apert. alt. 10.9, lat. 6.0; last whorl 15.8 mm.

Over a hundred examples of a large form which on first sight might well appear to represent a new species, but some individuals of smaller size approach so nearly to *badia* as to indicate the specific affinity of this slender, remarkable race, of which the most distinctive feature is the shortness of the aperture in relation to the length of the last whorl.

#### Succinea dakaensis Stur.

Ref. List No. 459.

1898. Succinea dakaensis Stur., S.A. Moll., p. 72, pl. iii, f. 52-54. D.F.

Shell of moderate size, almost exactly like badia at the same stage of development; the last whorls, however, may be a trifle more convex and the suture consequently a trifle deeper; in dorsal view of badia the right side from apex to perimeter has a slightly straighter aspect than in the present species, though that difference is so small that further material may well prove them conspecific. The largest of the type set is said to measure

Alt. 13.5, lat. 7.5; apert. alt. 9.1, lat. 5.0 mm.

Hab. S. RHODESIA. Daka River (Penther).

TRANSVAAL. Pietersburg (Geol. Survey S. Africa).

Type in Vienna Museum.

#### Succinea connollyi Prest.

(Pl. xv, f. 5.)

Ref. List No. 458.

1907. Succinea (?) badia Morel., Dixey & Longstaff, Trans. Entom. Soc., p. 361. N.

1912. Succinea connollyi Prest., A.M.N.H., ix, p. 445. D.F.

1936. ,, ,, Quick, Ann. Natal Mus. viii, pp. 23, 25, pl. ii, f. 2, 8–10; pl. iv, f. 3. D.F.A.R.\*

A large species of bright amber hue with particularly elongate aperture; the long, nearly straight columella merges into the paries, as in most others of the genus, almost imperceptibly in a gentle curve. A large paratype with 3 moderately convex whorls measures

Alt. 16.5, lat. 8.2; apert. alt. 12.4, lat. 6.7; last whorl 15.2 mm.

Hab. S. RHODESIA. Victoria Falls (Connolly).

Type in Tervueren Museum.

This species occasionally displays on the last whorl furrowing similar to that which gave its name to exarata.

### Succinea patentissima Pfr.

(Pl. xv, f. 11.)

Ref. List No. 463.

1853. Succinea patentissima Mke., Pfr., Zeitschr. f. Malak., x, p. 52. D.

\* Quick shows that this species and the next belong to the section or subgenus Oxyloma Westerlund, and differ considerably in their anatomy from both striata and exarata (=delalandei).

1922. Succinea patentissima Mke., Dup. & Putz., Ann. Soc. Zool. Belg., liii, p. 69. N.L.

1925. Succinea patentissima Mke., Conn., Trans. R. Soc. S. Africa, xii, p. 186. L.

1936. Succinea patentissima Mke., Quick, Ann. Natal Mus. viii, pp. 22, 23, 28, pl. ii, f. 3, 11–13; pl. iv, f. 4–5. D.F.A.R.

A miniature of the foregoing, distinguishable by its columella, of which the upper portion is white, slightly thickened into an angular twist just before joining the very narrow paries. The largest specimen I have seen, from Umgeni, with little more than 2 whorls, measures

Alt. 10.0, lat. 6.0; apert. alt. 7.8, lat. 4.5; last whorl 9.6 mm.

Hab. NATAL. Port Natal (type, Menke); Umgeni Lagoon (Burnup); Park Rennie; Illovo Lagoon (Cawston).

ZULULAND. Lake Sibayi (Toppin).

TRANSVAAL. Potchefstroom (Cawston).

S. RHODESIA. Victoria Falls (Farquhar).

LORENZO MARQUES. Lebombo Marsh, Rikatla (Junod); Wanetsi R., Majude District (Bell Marley).

Type ubi?

Quick (Proc. Mal. Soc., xx, p. 312) states that this species closely resembles *pfeifferi* Rossm. in its genitalia and genital orifice.

# Subspecies lomatiensis n.

(Pl. xv, f. 12.)

More slender and therefor with narrower aperture than type, the columella, though slightly twisted at top, is less so than in type and leaves a longer paries, while the second whorl is longer and far less convex. The only specimen yet to hand, with nearly 3 whorls, measures

Alt. 9.2, lat. 4.7; apert. alt. 7.2, lat. 3.7; last whorl 8.3 mm.

Hab. TRANSVAAL. Lomati River, near Swaziland border (M. v. R. Lee).

Type in British Museum.

#### Succinea arboricola Conn.

Ref. List No. 456.

1887. Succinea arborea Mouss., J. de C., xxxv, p. 297, pl. xii, f. 7. D.F.

1910. Succinea striata Krs., var., O. Bttg., Abh. Senckenb. Ges., xxxii, p. 449. N.

1912. Succinea arboricola (= arborea Mouss. 1887, non Ad. & Ang. 1863), Conn., Ann. S.A. Mus., xi, p. 220. N.

Three sets of small shells in my collection do not quite match any of the foregoing forms and I think are referable to the present species; they differ from *striata* only in slightly more slender contour, my most obese specimen, with 3 convex whorls, measuring  $9.0 \times 5.7$  mm.

Hab. BRITISH BECHUANALAND. Kalaruri (= Kalahari, type, Schinz); Lake Ngami, Okovango Marshes; Hardekol Drift, Botletle R. (Passarge).

DAMARALAND. Gobabis (striata var., Hermann).

CAPE PROVINCE. Karee Bosch Poort, near Carnarvon (Day).

TRANSVAAL. River near Pietersburg (Farquhar); Lake Chrissie, Ermelo (Junod).

Type in Zurich Museum.

#### Succinea exarata Krs.

(Pl. xv, f. 6-9.)

Ref. List Nos. 460, 461.

1821. Helix (Cochlohydra) elongata, var.  $\gamma$ , Fér., Tabl. Moll., pt. 3, p. 31 (or 27), L., and Hist. Moll., pl. xia, f. 11. F.

1848. Succinea exarata Krs., Südafr. Moll., p. 74, pl. iv, f. 15. D.F.

1851. ,, delalandii Pfr., Zeitschr. f. Malak., viii, p. 28. D.

1853. , delalandei Pfr., Mon. Hel., iii, p. 11. D.

1869. ,, ,, ,, var. *kurri* Mts., Mal. Blätt., xvi, p. 211. *D*.

1930. Succinea delalandei Pfr., Conn., Ann. S.A. Mus., xxix, p. 308.

1930. Succinea exarata Krs., Conn., ibid., p. 308. N.

1933. ,, ,, Germ., Bull. Mus. Paris, v, p. 138. D.

1936. ,, delalandei Pfr., Quick, Ann. Natal Mus. viii, pp. 22, 23, 31, pl. ii, f. 5, 7; pl. iii, f. 1-2; pl. iv, f. 6. D.F.A.R.

1936. Succinea dela<br/>landei Pfr., var. kurri Mts., Quick,  $ibid.,\ {\rm p.}$ 33. <br/> N.A.

Far more slender than other South African forms, with comparatively narrow and more elongate spire, though the last feature is rather variable, while owing to their greater elongation the whorls are rather less convex than in *striata* and *badia*. The specimen figured, from Maitland, measures

Alt. 11.7, lat. 6.2; apert. alt. 7.8, lat. 4.1; last whorl 10.1 mm.

Hab. NATAL. In swamps (exarata, Krauss); near Pietermaritz-burg (Burnup).

TRANSVAAL. Potchefstroom (Connolly); Olifants R. (Craven); Krüger Park (Haas).

CAPE PROVINCE. "Près des Marais salés" (Delalande); Maitland (Connolly).

CAPE PENINSULA. Baszaarms (Baas Harman's) Kraal (Benson); Seekoe Vlei; Hout Bay; Lake Side (Connolly); Fishhoek (D. Südpol. Expedition).

BECHUANALAND. Kuruman (Layard); Hope Vlei, near Vryburg (Rogers).

DAMARALAND. Gobabis (subfossil, Hermann); Grootfontein; Namutoni (Barnard); between Nuragas and Otjituo (Lightfoot).

Type of exarata in Stuttgart, kurri in Berlin, originals of delalandei in British Museum.

This species was unfortunately founded on two abnormal shells. in one of which the last whorl is scored with two, and the other with a single furrow, a feature which the describer admits having observed himself occasionally in amphibia Drap. (putris Lin.) and which I have noticed more than once in individuals of various African species. Delalandei was founded on somewhat immature specimens of a rather variable species by no means infrequent in the Cape Town district, of which well-grown examples represent the mature stage of both delandei and exarata, except that the furrows stressed by Krauss are of rare occurrence, though present on at least one shell of typical delalandei from Cape Flats in the British Museum, and I have Tomlin's full concurrence in uniting the two species.\* It would obviously be common sense to apply Pfeiffer's name delalandei to this species as a whole, and that given by Krauss to the abnormal exarate form, but in accordance with the rules of nomenclature exarata must stand as the specific name, and there is no object in perpetuating delalandei as even a varietal name for the normal form of this ill-named species.

The type pair are very slightly narrower than usual,  $9.5 \times 5.0$ , apert.  $6.7 \times 3.25$ , last whorl 8.6 mm., the actual type having two spiral lines, the upper of which is a shallow groove, arising on back of body whorl and continuing to aperture, while the second has a single groove only. The type of Martens' var. kurri was inadvertently described as 8 mm. in breadth, but its actual dimensions are alt. 13.0, lat. 6.0; apert. alt. 8.0, lat. 4.5; last whorl 11.2 mm., both shell and animal agreeing well with examples of delalandei from the Cape Peninsula.

<sup>\*</sup> A small series of this species just received from A. W. Rogers (8th June 1938), collected in subfossil condition at Strandfontein, on the coast of False Bay, S.E. of Seekoe Vlei, contains no fewer than 5 shells exhibiting one or two furrows as in the type pair.

#### SUBORDER Ditremata.

Eyes on summits of tentacles, but male and female genital orifices distant from each other; mantle entirely covering the back; shell absent.

#### FAMILY VERONICELLIDAE

(=Vaginulidae).

Terrestrial depressed slugs without a shell; back covered by a coriaceous mantle keeled at the edge; lower surface longitudinally tripartite, sole occupying the middle third and transversely striated; head retractile, 4 tentacles, upper cylindrical, contractile, lower bifid. Sexual openings widely separate, male behind lower right tentacle, female on underside of body near right margin of foot, about one-third to middle of its length; cloaca and respiratory orifice posterior.

There is no doubt whatever as to the name Veronicellidae having priority over Vaginulidae for this family, in spite of the fact that Blainville's original diagnosis is so faulty that it would be impossible to accept it if his actual genotype were not available for examination. But this is not the case; Veronicella laevis Blainville exists in excellent preservation in the British Museum, as stated by Heynemann in 1885 and Cockerell in 1893; it is so labelled by Charles Konig, who was on the Museum staff at the time of its description, and agrees so closely with the original figure as to prove its authenticity. It is a perfectly normal Vaginulid.

Many authors have essayed to partition the members of this family into genera, sub-genera, and sections, but they do not appear as yet to have attained any kind of unanimity on the matter, and as the anatomy of most of the South African species has not been treated, it may be advisable to leave them all in *Veronicella*, sensu lato, until they have been fully examined by a competent and wide-viewed anatomist; all appear from external features to belong to a single homogeneous group.

Genus *Veronicella* Blainville, 1817 (J. de Physique, lxxxv, p. 440). Type *V. laevis* Blainv.

Generic characters as in family.

# Veronicella natalensis (Krs.).

Ref. List No. 468.

1848. Vaginulus natalensis von Rapp, Krs., Südafr. Moll., p. 72. D.

1871. Vaginula natalensis Krs., P. Fischer, Nouv. Arch. Mus. Paris, Mém. vii, p. 153. D.

1925. Meisenheimeria natalensis Krs. (=saxicola Ckll.), Hoffm., Jen. Zeitschr., lxi, pp. 134, 135, 224. D.

"Body elongate oblong, convex, subcylindrical, whitish grey, very finely punctate, rather darker on edge, truncate in front, widening to the rear, foot-sole transversely striate, 8.5 mm. broad, truncate in front, narrowing behind to a point which projects about  $2\frac{1}{4}$  mm. beyond the mantle. Animal long. 83, lat. 18 mm."

Female orifice, fide Cockerell,  $\frac{6}{10}$ ths of length from head.

Hab. NATAL (type, Krauss); Port Shepstone (Burnup); Pinetown (in Vienna Museum).

CAPE PROVINCE. Kowie District (Penther). Type in Stuttgart Museum.

# Veronicella saxicola Ckll.

Ref. List No. 470.

1893. Veronicella saxicola Ckll., Conchologist, ii, pp. 194, 216. D. 1925. Meisenheimeria saxicola Ckll., Hoffm., Jen. Zeitschr., lxi, pp. 135, 220. N.

"Sole not projecting posteriorly, mantle granulose, no raised warts, no sort of keel. Dark red-brown, mottle-streaked with blackish above, unicolourous below; a paler middle line slightly indicated posteriorly. When young paler, with a more obvious middle line. Female opening in .56 of total length, 2 mm. from sole and 32 from head;

"Long. 57, lat. 14; sole lat. 6 mm. "Nearest perhaps to V. Petersi."

Hab. CAPE PROVINCE. Port Elizabeth, under stones (type, Craven).

NATAL. Pietermaritzburg (Burnup).

Type in British Museum.

Hoffmann places this species in synonymy of natalensis.

# Veronicella petersi (Mts.).

Ref. List No. 469.

1879. Vaginulus petersi Mts., Monatsb. Akad. Wiss. Berlin, p. 736. D.

1925. Veronicella petersi Mts., Conn., Trans. R. Soc. S. Africa, xii, p. 187. L.

1925. Meisenheimeria petersi Mts., Hoffm., Jen. Zeitschr., lxi, pp. 125, 226. N.

"Mantle thickly covered with fine, somewhat irregular granules, blackish with light brown stripe down centre, underside uniform blackish, sole bright brown. Respiratory orifice round, situate somewhat laterally at end of foot, genital orifice rather more than midway from front of mantle. Length in alcohol 40, breadth 14 mm."

Hab. LORENZO MARQUES. Inhambane (type, Peters).

Type in Berlin Museum.

Also known from Netia, Mozambique.

Hoffmann (l.c., p. 125) suggests that this species is conspecific with *V. brevis* Fischer, and on p. 226 places both in the synonymy of *V. alté* Fér.

# Veronicella maura (Heynem.).

#### Ref. List No. 467.

1885. Vaginula maura Heynem., Jahrb. D. Mal. Ges., xii, pp. 7, 104, pl. i, f. 6-7. D.F.

1925. Veronicella maura Heynem., Conn., Trans. R. Soc. S. Africa, xii, p. 187. L.

1925. Meisenheimeria maura Heynem., Hoffm., Jen. Zeitschr., lxi, pp. 125, 226. N.

Mantle uniform dull black above, dark greyish yellow beneath, somewhat darker at keel, sole very slightly paler; keel prominent, mantle minutely granulate, almost smooth but not glossy, cross-lines of sole very fine, close and numerous. Genital orifice 42·3 mm. from front, exactly half-way between margins of sole and keel.

Long. 70, lat. 23; breadth of sole 11 mm.

Hab. LORENZO MARQUES. Delagoa Bay (type, Mrs. Monteiro).

Type in British Museum.

Hoffmann (l.c., p. 226) consigns this, as well as the last, together with twenty other species to the synonymy of alté Fér.; he is very possibly correct, and my sole reasons for retaining their specific identity for the present are that their anatomy has not been worked out, and that their colour is distinctive; maura is uniform blackish above and nearly uniform greyish yellow beneath, while petersi is black on back, with a very narrow yellow mid-dorsal line, hyponota grey black, with drab coloured sole; the two patterns appear constant, in the few examples from different localities that I have seen, and are in strong contrast with one another.

Veronicella obscura (Srth.)(?). (Pl. xvi, f. 19.)

1896. Vaginula obscura Srth., D.O.A., iv, p. 17, pl. ii, f. 15. D.F. 1925. Meisenheimeria obscura Srth., Hoffm., Jen. Zeitschr., lxi, p. 131, N., and p. 223 (in synonymy of M. stuhlmanni Srth.).

The slug that I ascribe tentatively to this species is subcylindrical, rounded fore and aft, finely granulate, dull greenish brown above with a narrow orange stripe down the centre, flanked on each side by a row of irregular dark dots and longitudinal flecks, with a second row, making four in all, of sparser, fainter dots near the margins, which are paler brown in common with the underside; sole a little paler and considerably narrower than either side area. Genital opening inconspicuous, two-thirds of length from front, cloaca situate obliquely just to the right of end of sole.

Length in alcohol 31, greatest breadth 9, sole 2.7 mm.

Hab. S. RHODESIA. Victoria Falls (Connolly).

Described from Undussuma (Stuhlmann).

Type in Berlin Museum.

Founded on a very immature singleton, of which the description and figure of the upper surface appear to agree with the slug described above. This is itself immature, but there are several far larger unnamed specimens from Nyasaland in the British Museum which may be adult examples of Simroth's species and help to bridge the gap between Undussuma and the Victoria Falls. As in many of these slugs, the bright colours of the juveniles tend to become drabber with increasing age and are hardly discernible in fully mature spirit specimens.

#### FAMILY ONCHIDIIDAE.

Slugs destitute of a shell, except in the embryo. Body oval; back somewhat arched, entirely covered by the mantle, which contains siliceous spicules and is usually provided with tubercles that are sometimes transformed into gills and often bear eyes of a peculiar nature. Head with a pair of retractile eye-bearing tentacles. Lung and kidney in the hinder part of the body, the opening of the former being a short distance behind the anus. Female opening also at the posterior end, but to the right of the anus; male opening on the head. Radular teeth arranged in oblique rows on each side of the middle line, usually with small ectocones, larger mesocones and anterior basal prolongations.

Labbé has recently suggested several radical alterations in the classification of this family, but I do not find them to be generally accepted, so adhere for the present to its more conservative treat-

ment. Its habit is almost entirely marine between tide-marks, and the only reason for its inclusion in the present work is because it has usually been included by earlier authors among African non-marine families.

> Genus Onchidium Buchanan, 1800 (Linn. Trans., v, p. 132). Type O. typhae Buch.

Animal large or of medium size; male genital opening on inner side of and below the right tentacle; penis often with cartilaginous elements and an appendicular gland. Undersides of body without hyponotal line; mantle border not notched and without multicellular glands; branchial clusters sometimes present, dorsal eyes usually present. Lung and kidney symmetrical; no jaw; vagina without gland.

> Subgenus Peronia Fleming, 1822. (Phil. Zool., ii, p. 463). Type O. peronii Cuv.

Animal with dorsal gills.

# Onchidium peronii Cuv. Ref. List No. 472.

1804. Onchidium peronii Cuv., Ann. Mus. Nat. Hist. Paris, v, p. 38, pl. vi, f. 1-9. D.A.

1825. Peronia mauritiana Blainv., Man. de Malac., p. 489, pl. xlvi (1827), f. 7. F.

1879. Onchidium peronii Cuv., Mts., Monats.-Ber. Preuss. Akad. Wiss., p. 735. N.

1893. Onchidium peroni Cuv. (=melanopneumon Bergh and tonganum Q. & G.), Plate, Zool. Jahrb. Jena, vii, 1, p. 172, pl. xii, f. 85. D.F.

1910. Onchidium peroni Cuv., Cllge., Ann. Natal Mus., ii, p. 171. L. peronii Cuv., Bretnall, Rec. Austral. Mus., xii, 1919. p. 311. D.

1925. Onchidium peroni Cuv., Conn., Trans. R. Soc. S. Africa, xii, p. 187. L.

1928. Oncidium peroni Cuv., Hoffm., Zool. Jahrb. Jena, lv (Syst.), pp. 44, 71. D.N. Synonymy.

1934. Peronia peronii Cuv., Labbé, Ann. Inst. Océanogr., xiv, p. 190. D.

Body elongate oval, not strongly arched, mantle border smooth in smaller and somewhat notched in larger specimens; head large and projecting 6–8 mm. beyond mantle border; hyponota a little narrower than foot-sole. Mantle liberally covered with large and small papillae and with coarse and fine granules irregularly arranged, papillae in some areas more or less grouped in three distinct formations: (i) a central papilla around which are arranged 4–6 papillae of the same size; (ii) central papillae actually made up of 4 small papillae, around which are 5–7 bunches of 3 papillae in each bunch; and (iii) groups of 3–4 papillae appearing as small tufts. The majority of the papillae bear dorsal eyes, more numerous in the middle and posterior field, but present even around mantle margin; branchial plumes best developed in large specimens, close to posterior mantle border. Ground colour above olive, with irregular pattern of lighter and darker patches, papillae and granules in some cases half and half; foot and underside uniform yellowish, top of head rather more olive in hue.

Male genital opening situated in a transverse slit about 1.5 mm. long; anus on an anal papilla emanating from foot groove; tail of foot notched, the papilla standing therein unprotected; it is conical in shape and attains a height of 4 mm.; respiratory opening median, 8 mm. behind anal papilla, female opening on a small papilla at head of genital groove, which is very conspicuous, running as far as the frontal shield, where it turns inwards to the pore of foot gland situated

behind the mouth. Anterior portion of penis armed with hooks.

Long. 104, lat. 68, alt. 20; foot-sole lat. 29 mm., a smaller specimen measuring  $50\times35\times20$  mm. (Bretnall).

Hab. NATAL coast (fide Krauss); Congella (Burnup fide Collinge). LORENZO MARQUES. Inhambane (Peters, fide Martens).

Described from Mauritius and Timor (?) and distributed eastwards to the Pacific Ocean; the former record of Green Point has been shown to refer to *capensis* Watson.

Type ubi?

Martens writes that this slug's local name at Inhambane is "Maringo"; it abounds on the water's edge, where each individual inhabits a small hole of its own. They are considered excellent food by the negroes, tasting like *Helix*, being first dried over the fire in a pan to free them from salt water, after which fresh water is poured over them and cooking is completed. In view, however, of the confusion which has prevailed between the present species and *verruculatum*, it is open to question to which species the foregoing records actually refer, and even whether the true *O. peronii* Cuv. really exists in South Africa?

Onchidium verruculatum Cuv. Ref. List No. 473 (as savignyi).

1826. Onchidium peronii Cuv., Aud., Descr. de l'Égypte, i, 4, p. 19, and ii (1817), pl. ii (Moll.), f. 3 (1-8). N.F.

1830. Onchidium verruculatum (Descr. Ég., pl. ii, f. 3), Cuv., Règne Animal, iii, p. 46.  $\,N.\,$ 

1865. Peronia verruculata Cuv., Kfstn., Zeitschr. Wiss. Zool., xv, p. 86, pl. vi, f. 14-16. A.N.

1869. *Peronia savignii* (Savigny, Descr. Ég., pl. ii, f. 1–5) Récl., Actes. Soc. Lin. Bordeaux, xxvii, p. 61. *Nom. nov.* 

1870. Onchidium verruculatum Cuv., Nev., Proc. Asiat. Soc. Bengal, p. 304. D.

1877. Onchidium verruculatum Cuv., Semp., Reis. Arch. Phil. pt. 2, iii, 3, pp. 3-45, pl. A, f. 5, 10; pl. B, f. 1-2, 6. A. Eyes.

1885. Onchidium verruculatum Cuv., Semp., ibid., ii, 3, p. 255, pl. xxi, f. 1; pl. xxii, f. 3-4. D.A.R.

1885. Onchidium savignyi Semp., ibid., p. 260, pl. xix, f. 6; pl. xx, f. 1; pl. xxii, f. 5-9. D.F.A.

1903. Onchidium savignyi Semp., Smith, Proc. Mal. Soc., v, p. 401. N.

1910. Onchidium savignyi Semp., Cllge., Ann. Natal Mus., ii, p. 172. L.

1919. Onchidium verruculatum Cuv., Bretnall, Rec. Austral. Mus., xii, p. 309. D.

1926. Onchidium (Peronia) peroni Cuv., Plry., Mém. Inst. Égypte, xi, p. 26, pl. iii, f. 3. F.

1928. Oncidium verruculatum Cuv. (= savignyi Récl., ferrugineum Less., alderi Gray, elberti Srth., and punctatum Q. & G.) Hoffm., Zool. Jahrb. Jena, lv (Syst.), pp. 44, 72, 106. N.L.

1934. Peronia verruculata Cuv., Labbé, Ann. Inst. Océanogr., xiv, p. 192.  $\,D.\,$ 

Only a few of the voluminous references are included above.

Body oval, back not strongly arched, head large, tentacles long and cylindrical; mantle border smooth, hyponota considerably narrower than the sole; mantle liberally covered with single tubercles ranging up to 1·2 mm. in diameter, and compound rosettes formed by from 5 to 7 single ones; short bunched branchial papillae appear on the posterior field of the mantle; some of the large tubercles bear from 2 to 5 eyes. Colour of back olive, sometimes flecked and sprinkled with brown and blue-grey, papilla clumps also unicoloured or chequered, underside somewhat paler olive than upper, top of head as dark as mantle. Anus situate on a small papilla partly protected by tail of foot, respiratory orifice median, somewhat nearer anus than mantle border, female orifice near anus and respiratory orifice, male under right tentacle; anterior portion of penis with cartilaginous hooks, posterior portion smooth.

Savigny's figure 3 (1, 2), said to be life size, is  $34 \times 26 \times 21$  mm. in length, breadth, and altitude, width of sole 16 mm., but the South African specimens attributed to this species attain much larger dimensions.

Hab. NATAL. Port Natal (Wahlberg); Scottburgh (Burnup).

Since O. verruculatum and savignii were both founded on the same figure in Description de l'Égypte, their synonymy is obvious and the

Red Sea example stands as type; the species has a distribution somewhat similar to that of *peronii* from the east coast of Africa to Japan and Australia; the Holotype is probably lost.

Subgenus Onchidium s.s.
Without dorsal gills.
Onchidium burnupi Clige.
Ref. List No. 471.

1902. Onchidium burnupi Clige., J. of Malac., ix, p. 17, f. 1-2. D.F.

1910. Onchidium burnupi Cllge., Ann. Natal Mus., ii, p. 171. D. 1928. Oncidium ,, ,, Hoffm., Zool. Jahrb. Jena, lv (Syst.), p. 84. N.

Notum finely granulated, yellowish irregularly blotched with blackish green, these blotches being prominent at the edge and in the middle of the notum; dorsal eyes irregularly scattered; head large; hyponotum greenish grey; foot-sole greyish yellow, faintly marked with fine transverse wrinkles. Male generative orifice on inner side of right upper and lower tentacles.

Length of notum (in alcohol) 11, breadth 9 mm.; breadth of hyponotum 3 mm.; length of foot-sole 8.5, breadth 3 mm.

Hab. NATAL. Umlaas Lagoon (Burnup). Type in Cambridge Museum.

Genus Onchidella Gray, 1850 (Fig. Moll. Anim., iv, p. 117). Type O. nigricans Q. & G.

Animal small or of medium size; male genital opening situated to the outside of right tentacle, penis usually without gland or cartilaginous elements. Mantle border finely notched or lobed, frequently with multicellular glands discharging at apex of lobes; branchial plumes and dorsal eyes absent; a slender longitudinal fold, or hyponotal line, runs from the tentacle to the respiratory opening near the foot on each side, thus separating the hyponota into a broad, finely granulate outer zone and a smooth inner zone; the groove on right side of foot extends backward to the anus. Lung and kidney symmetrical; jaw delicate, but usually present; vagina with a lateral gland.

Owing presumably to long immersion in spirit, the coloration and certain other external features of all examples of this genus that have been available for examination appear to have undergone considerable modification from the original descriptions, which, however, I have thought best to copy to a large extent in the following pages.

Onchidella maculata Plate.

#### Ref. List No. 474.

1893. Oncidiella maculata Plate, Zool. Jahrb. Jena (Anat.), vii, 1, p. 201, pl. vii, f. 4; pl. ix, f. 43-44; pl. x, f. 45-49, 52; pl. xi, f. 68; pl. xii, f. 101. D.F.A.R.

1910. Oncidiella maculata Plate, Thiele, Jena Denkschr, xvi, p. 270. L.

1928. Oncidiella maculata Plate (=capensis Wats.), Hoffm., Zool. Jahrb. Jena, lv (Syst.), p. 98. N.

Body oval, pretty strongly arched when extended, hemispherical when contracted, mantle border notched, the notches corresponding to the apertures of the large glands, from 20 to 24 in number, which are rendered conspicuous by the flat light yellow tubercles which contain them; back smooth or very finely granulate, the larger white spots rising into flat warts. The hyponota divide into an inner and an outer field, as there runs from the base of the tentacle on each side a thin fold (hyponotal line) to the respiratory orifice; the foot groove of the right side is separate from this and lies on the inner side of it and so close to the foot that it does not catch the eye in a view of the ventral surface, being covered by the projecting edge of the foot; the outer field of the hyponotum is about 4 times as broad as the inner and is thickly covered with small light tubercles, only visible under a lens. Back usually slate-blue, occasionally grey or lightish brown, with distributed thereon large connected whitish spots and bands in many patterns; frequently a light stripe down middle of back, sometimes so large as to occupy the entire mid-field, or asymmetrically one side of it; whole surface of mantle also covered with little white dots ½ to 1 mm. apart; underside light yellowish; sole a little darker than hyponota; a darker shade stretches from the anus to the edges. Anus covered by point of foot; respiratory orifice median, <sup>1</sup>/<sub>3</sub>rd of the distance from anus to mantle-edge; male genital opening outside and somewhat behind the right tentacle; pedal groove very clear, extending back to anus, but female opening not coinciding with anus. No jaw, radula formula 105 + 1 + 105. Long. 11, lat. 84, alt. 6; sole lat. 5 mm. (Plate).

Hab. GREAT NAMAQUALAND. Angra Pequena (= Lüderitz-bucht, type, Buchholtz; Schultze).

Paratypes in British Museum.

According to Plate's description and figures, this species appears to differ anatomically from those found at the Cape in having no vesicula seminalis, penis-papilla, nor jaw, and in the exact position of the vaginal gland.

# Onchidella capensis Wats.

1900. Onchidium peroni Cuv., Cllge., Ann. S.A. Mus., ii, p. 7. L.

1901. ,, ,, ,, ,, ibid., p. 235. L. 1925. Onchidella capensis Wats., Ann. S.A. Mus., xx, pp. 239 et seq., pl. xxvii, f. 4-11; pl. xxviii, f. 12, 14; pl. xxxi, f. 58. D.F.A.R.

1928. Oncidiella maculata Plate (=capensis Wats.) Hoffm., Zool. Jahhrb. Jena, lv (Syst.), p. 98. N.

Body broadly oval, back strongly arched and bearing numerous papillae, which are rather more crowded than in O. pulchella, but of which the larger are less prominent; marginal glands usually about 24 in number, their position indicated by small swellings round the mantle-edge; hyponotum rather broad and flat. Colour of back in spirit grey, sometimes rather dark, but generally with somewhat paler, very irregular and ill-defined patches, chiefly situated towards middle of back; the tops of the larger papillae and the small marginal swellings also pale; foot tinged with yellow; hyponotum whitish, except at hinder end near opening of mantle-cavity, where it is strongly tinged with grey.

Long. 7.5, lat. 5.9, alt. max. 3.5 mm.

Hab. CAPE PENINSULA. Green Point (peroni, Purcell); Sea Point (Barnard).

Type in South African Museum.

Externally this species can be distinguished from the next (pulchella) by its greater breadth, rather smaller and more numerous papillae, and different coloration; it differs in internal structure in the pulmonary network being a little finer; albumen glands rather smaller and receptaculum seminis larger; vagina relatively shorter, with a rather less prominent lateral protuberance, and central teeth of radula longer and narrower; this feature is about  $2\cdot 6\times 1$  mm. when flattened, formula  $(110+1+109)\times 80$ .

O. capensis differs externally from maculata in the much smaller size of full-grown animals, darker and more uniform colour of back and in the fact that the papillae arise from a uniformly dark surface, whereas in Plate's species the larger usually have a ring of dark pigment round their bases, and the marginal glands are also more sharply defined, as in capensis they are more uniform in shade with the intermediate notches.

## var. paucidentata Wats.

1925. Onchidella capensis var. paucidentata Wats., Ann. S.A. Mus., xx, pp. 239 et seq., pl. xxviii, f. 13. D.A.R.

Differs from type in slightly smaller size, papillae on back a little more prominent and hyponotum uniformly white, without grey area at hinder end.

Long. 5.8, lat. 4.9, alt. max. 3.5 mm.

Hab. CAPE PENINSULA. Buffels Bay (Barnard).

Type in South African Museum.

Radula about  $2.3 \times 0.9$  mm. when flattened, central teeth, though not so short and broad as in *O. pulchella*, are a little shorter and broader than in *capensis* typica, and the total number of teeth smaller, formula  $(78+1+77)\times 72$ .

# Onchidella pulchella Wats.

1925. Onchidella pulchella Wats., Ann. S.A. Mus., xx, pp. 239 et seq., pl. xxvii, f. 1-3; pl. xxviii, f. 15-35; pl. xxix, f. 36-44; pl. xxx, f. 45-54; pl. xxxi, f. 55-57, 59-62. D.F.A.R.

1928. Oncidiella maculata Plate, var. pulchella (=var. paucidentata Wats.), Hoffm., Zool. Jahrb. Jena, iv (Syst.), p. 100. N.

Body oval, but rather narrow, especially towards the anterior end; back rather strongly arched and bearing a number of scattered papillae, the larger of which are very prominent. Marginal glands usually about 22 in number, their positions being indicated by a series of prominent swellings round the mantle-edge. Colour of back in spirit dark grey with conspicuous white patches, including an irregular band along the middle of the back, an irregular patch on the right side towards the hinder end, and usually some smaller white patches; the tops of the more prominent papillae and the comparatively large marginal swellings are also white; foot slightly tinged with yellow; hyponotum uniformly white.

Long. 5.8, lat. 3.6, alt. max. 2.5 mm.

Hab. CAPE PENINSULA. St. James (Lightfoot).

Type in South African Museum.

Differs in internal structure from O. capensis Wats. in that the skin is slightly thicker, the pulmonary network appears to be a little coarser, the albumen glands rather larger and the receptaculum seminis smaller; vagina slightly longer, with a more prominent lateral protuberance, and central teeth of radula broader and shorter. Radula about  $1.8 \times 0.85$  mm. when flattened, formula  $(86 + 1 + 86) \times 68$ .

This small species can be easily distinguished from the last by its narrower form and much more conspicuous markings.

It will be seen from the foregoing references that Hoffmann considers capensis Wats. to be synonymous with maculata Plate; and pulchella Wats., with which he merges capensis var. paucidentata Wats., to be a mere variety of Plate's species. Hoffmann, however, had apparently not examined and compared any of these forms himself, and comparison of the external features of the material in the British Museum appears to support the English author's arrangement.

#### SUBORDER Basommatophora.

Eyes situate on head without stalks, usually at base of a pair of tentacles; genital apertures usually separate; shell always present.

#### TRIBE ACTOPHILA.

Shell spiral, inoperculate, usually thicker than in the Hygrophila; head with two tentacles, eyes usually at their base; buccal cavity usually with fibrous jaw, radula with numerous teeth in nearly

straight rows, kidney without ureter. The animals generally live on or near the sea coast.

# FAMILY ELLOBIIDAE

(=Auriculidae).

Shell ovate, obconic or acuminate, with one or more folds on columella and often on paries, labrum often thickened or toothed, internal partitions often absorbed. Tentacles rounded in section, usually tapering; pulmonary orifice restricted to hind part of mantle border; penis connected with the posterior genital opening by a groove.

# Subfamily Ellobiinae.

(=Auriculinae).

Shell usually ovate to acuminate, aperture rather narrow, with one fold on columella and usually one or more on paries; foot-sole undivided; radula with unicuspid central and lateral teeth, marginals frequently with an endocone in addition to the mesocone, but no ectocones; nervous system with visceral ganglia further apart than usual; posterior genital opening hermaphrodite, the vas deferens originating from the groove between it and the male opening; vagina short or absent; penis rather short.

Genus Auriculastra Mts., 1880 (Meeresfauna Mauritius, p. 207). Type Auricula elongata Küst.

Shell rather slender, smooth, subfusiform, columella truncate, with one fold, sometimes weak, and one on paries; teeth of radula fairly broad and short, laterals unicuspid, marginals with small additional inner cusp.

# Auriculastra radiolata (Morel.).

Ref. List No. 486.

1848. Auricula pellucens Mke., Krs., Südafr. Moll., p. 82. N.

1860. Melampus radiolatus Morel., Séries Conch., ii, p. 93, pl. vi, f. 11. D.F.

1899. Auricula durbanica M. & P., A.M.N.H., iv, pp. 193, 199, pl. iii, f. 14. D.F.

1912. Auriculastra radiolata Morel. (= durbanica M. & P.), Conn., Ann. S.A. Mus., xi, p. 231. N.

Shell of medium size, acuminate subulate, imperforate, thin, smooth, glossy, transparent, pale olivaceous. Spire produced, sides straight, apex nearly always deficient. Whorls probably 6-7, nearly flat above, broadest at top of labrum. sculptured with weak growth striolae, crossed by extremely close, regular, undulating, microspiral lines, which are only visible on freshest specimens; suture simple, shallow. Aperture narrow, nearly vertical, with a short horizontal fold near base of paries and a weak protuberance on columella; labrum simple, edentate. The shell described, from Durban, with 5 remaining whorls, measures Long. 11.7, lat. 5.3; apert. alt. 7.9, lat. 2.0; last whorl 10.0 mm.

Hab. NATAL ("pellucens," Wahlberg; radiolata, Nevill); Cato's Creek, Durban; mouths of Umlaas and Umkomaas Rivers (durbanica, Burnup); Isipingo (Cawston).

Described from Zanzibar; both types in British Museum.

Auriculastra catonis (M. & P.). (Pl. xv, f. 18.) Ref. List No. 485.

1899. Auricula catonis M. & P., A.M.N.H., iv, p. 199, pl. iii, f. 13. D.F.

What remain of the much decollate examples available for examination are far more narrow than the foregoing, with which they appear to agree in other respects, except that the columellar fold is a little sharper. The type, with only 2 remaining whorls, measures

Long. 8.5, lat. 3.8; apert. alt. 6.4, lat. 1.8; last whorl 8.0 mm.

Hab. NATAL. Cato's Creek, Durban (type); mouths of Umlaas and Umkomaas Rivers (Burnup).

Type in British Museum.

#### Auriculastra acuta Conn.

1922. Auriculastra acuta Conn., A.M.N.H., x, p. 121. D. Trans. R. Soc. S. Africa, xii, p. 188, pl. iv, f. 29. N.F.

A fusiform shell with straight-sided and comparatively longer spire than any other African member of the genus, the sides meeting at an angle of about 48°. Whorls 7, almost flat, each about one-third greater in altitude than its predecessor, sculptured with very faint, close, regular, nearly straight transverse striae, and engraved on the early post-apical whorls with close, regular, microspiral lines, which are practically absent from the last and only apparent on fresh specimens. Aperture narrow, labrum simple, edentate, columella short and straight, thickly calloused, with a small, but far-entering fold, parietal plica strong, acute, situate near top of callus.

Long. 17.8, lat. 8.0; apert. alt. 10.3, lat. 2.7; last whorl 13.3 mm.

Hab. LORENZO MARQUES. Estuary of Komati River (Juned). Type in Kimberley Museum.

Genus Phytia Gray, 1821
(London Medical Repository, xv, p. 231)
(= Alexia Leach, Monica Ads. and Kochia Plry.).
Type Voluta denticulata Mont. (myosotis Drap.).

Shell acuminate ovate, usually smooth, with one fold on columella and others on paries and occasionally on labrum. Central tooth of radula with a short cusp, laterals large, marginals with inner accessory cusps; a pair of tubercles on front of snout represent the lower tentacles of land snails.

Phytia acuminata (Morel.). Ref. List No. 488.

1889. Alexia acuminata Morel., J. de C., xxxvii, p. 15, pl. i, f. 11. D.F.

1889. Alexia pulchella Morel., ibid., p. 15, pl. i, f. 10. D.F.

Morelet founded his two species on very immature specimens, about 4½ mm. long, which merge into one another; mature examples from Port Elizabeth are small, much elongate acuminate ovate, rimate, fairly thin, smooth, slightly glossy, corneous buff or brown, often with a pale, narrow infrasutural band, extreme apex usually milk-white. Spire acuminate, sides nearly straight, apex submamillate. Whorls 8, nearly flat above, regularly and rapidly increasing, broadest near top of aperture, extreme apex smooth, next 2½ microscopically engraved with 6 or more regular, spiral lines of incised dots, which usually fade away towards the end of the 3rd whorl, transverse sculpture consisting of slightly distant, regular, vertical striolae, strongest for some distance below the suture, which is margined and shallow. Aperture narrowly acuminate ovate, outer lip simple, usually edentate, paries with a strong plait, inclined slightly downwards, at its base and usually a weak tubercle or small denticle some distance higher up, columella short, concave, fold tuberculate, margin narrowly triangularly reflexed, practically obliterating the rima.

Long. 10.0, lat. 4.3; apert. alt. 4.4, lat. 1.9; last whorl 7.3 mm.

Hab. CAPE PROVINCE. Port Elizabeth (type, Crawford; Farquhar); rather small and slender form from Keurbooms R. estuary, Plettenberg Bay (Barnard).

Types in British Museum.

This species often develops a varix at certain stages of growth, which imparts to quite young shells an appearance of maturity. It appears to be identical with *P. bicolor* (Morel.) of the Azores and Canary Is., which Wollaston was inclined to unite with the European *myosotis* Drap., an opinion in which Tomlin and myself concur.

Genus *Cassidula* Fér., 1821 (Tabl. Moll., pt. iii, p. 109 (or 105))

(= Rhodostoma Swainson and Sidula Gray, 1840).

Type Bulimus auris felis Brug.

Shell ovate, whorls usually showing spiral sculpture, one fold on columella and one on paries, with frequently a tubercle some distance above the latter, outerlip thickened; teeth of radula numerous, long and very blunt, laterals and marginals with mesocones, latter also with a small inner cusp.

# Cassidula labrella (Desh.). Ref. List No. 487.

1830. Auricula labrella Desh., Enc. Méth. Vers., ii, p. 92. D.

1841. " " " Küst., Conch. Cab., p. 22, pl. ii, f. 4-5. D.F.

1841. Auricula kraussii Küst., ibid., p. 24, pl. iii, f. 6-8. D.F.

1856. ,, lutescens Pfr., Mon. Auric., p. 113. D.

1874. Cassidula labrella Desh. (= kraussi and lutescens), Jick., Fauna N.-O.-Afr., p. 186. D.

1921. Cassidula labrella Desh., Germ., Faune Mascareignes, p. 263. D.

Shell of medium size, acuminate ovate, rimate, solid, smooth, rather dull, deep brown, peristomatal processes pale buff. Spire almost rectangularly conic, sides straight. Whorls 6½, flat above, greatest breadth at labral sinus, 1st smooth, remainder sculptured with close, weak, vertical striolae, and on the upper part from 3 to 7 strong spiral sulci, which continue around the last whorl; suture shallow. Aperture narrow, nearly vertical, peristome thick, paries bearing a weak tubercle near the top and a fairly strong plait, slightly inclined downwards, near the bottom, columellar fold strong, horizontal, emerging to margin, labrum with well-marked sinus, at base of which are a weaker upper and a very strong lower tooth, the latter merging into a strong internal rib, parallel to the margin, which continues down the labrum and round the base to the columella, which is short, concave, margin rather narrowly reflexed, rima encircled by an exceedingly strong basal keel, of paler colour than the shell.

Long. 12.0, lat. 7.2; apert. alt. (extern.) 7.8, lat. (extern.) 3.8; last whorl 9.5 mm.

Hab. NATAL. Mouth of Umlaas River (kraussii Krauss); Durban (Burnup); Isipingo (Cawston).

CAPE PROVINCE. Zwartkops River marshes, near Port Elizabeth (Crawford).

Type of kraussii in Stuttgart Museum; labrella ubi?

C. labrella was described from Mauritius, kraussii from Natal, and the hab. of lutescens was unknown.

# Subfamily PEDIPEDINAE.

Shell with aperture less narrow than in the other subfamilies; 3 folds on columella and penultimate whorl. Teeth of radula small and very numerous, central narrow with small mesocone, laterals also narrow, usually with endocone, marginals broader, with several pointed, nearly equal denticles. Foot-sole with a transverse groove; end of genital canal divided.

Genus Pedipes Fér., 1821

(Tabl. Syst., pt. 3, pp. 99 (or 103) and 109 (or 113)).

Type Bulimus pedipes Brug. (=Helix afra Gmel.).

Shell solid, ovate or globose, spirally sculptured; aperture usually with a fold within the labrum, as well as two on the columella and one on the penultimate wall. Endocones on lateral teeth of radula a little smaller than the mesocones.

Pedipes affinis Fér.

(Pl. xv, f. 17.)

Ref. List No. 484.

1821. Pedipes affinis Fér., Tabl. Moll., pt. 3, p. 109 (or 113). D. 1863. ,, ,, ,, Desh., Notes sur l'Ile Réunion, ii, E, p. 83, pl. x, f. 5-6. D.F.

1921. Pedipes affinis Fér., Germ., Faune Mal. Mascareignes, p. 254. D.

Shell (of a Durban example) small, ovate, rimate, solid, rather smooth, glossy, deep buff, apertural process white. Spire moderately produced, sides straight, summit acute. Whorls 5, not very convex, 1st involute at extreme tip, which dips into a minute conical well and is smooth, remainder sculptured with very weak transverse striolae and strong spiral grooves, which extend along the inner, but not the outer, wall of the well, and in the mature example described are practically invisible below periphery of last whorl, though present on the entire surface of an immature specimen from Port Shepstone; suture simple, shallow. Aperture ovate, peristome furnished with an internal ridge, dentition 4-fold; a strong inrunning horizontal plait half-way down the labrum; two rather shorter, at centre and top of columella, and a very strong oblique lamella on centre of paries; columella erect, thickened, callus continuous.

Long. 6.6, lat. 3.5; apert. alt. 3.7, lat. 1.7; last whorl 5.3 mm.

Hab. NATAL. Durban; Port Shepstone (Burnup).

Type ubi?

Described from Reunion and recorded from the Red Sea.

The shell described by Deshayes measured  $7 \times 4$  mm. and had the surface of all the whorls ornamented with fine spiral grooves, fairly

close and finely punctate, all which is borne out in his excellent figure, but in most mature examples from Mauritius and elsewhere attributable to this species the grooving is apt to weaken very greatly or disappear entirely, possibly from friction or slight weathering, below the periphery of the last whorl. I see no valid reason, however, for regarding the South African specimens as other than conspecific.

Genus Marinula King, 1832 (Zool. Journ., v, pp. 343, 344). Type M. pepita King (=Cremnobates Swainson, 1855).

Shell fairly solid, unicoloured, spire shorter than aperture, whorls few, comparatively convex, labrum simple, edentate, and not more than 3 folds on labium. Nervous system with visceral ganglia slightly further apart than usual; vas deferens separating from female duct some distance above the female opening; vagina rather short; penis long. Endocones on lateral teeth of radula much smaller than the mesocones.

#### Marinula tristanensis Conn.

Ref. List No. 483.

1912. Marinula sp., Conn., Ann. S.A. Mus., xi, p. 230. N.L.
1915. ,, tristanensis Conn., Ann. S.A. Mus., xiii, p. 108.
D.F.A.R.

Shell small, imperforate, purple-black. Spire about two-thirds length of aperture, sides rather convex, apex acute. Whorls  $3\frac{3}{4}$ , not very convex, rapidly increasing, with fine, irregular striation following the lines of growth; suture very shallow. Aperture acuminate ovate, labrum thin, simple, labium with 3 white dental processes: a prominent upper linguiform fold parallel to and about 1.7 mm. from the labrum; a short, rather conical fold about half-way between it and the base and a minute columellar fold rather nearer the 2nd tooth than the base.

Long. 10.4, lat. 5.5; apert. alt. 6.7, lat. 4.7; last whorl 9.6 mm.

Hab. CAPE PENINSULA. Camps Bay (Dale; McBean). CAPE PROVINCE. Dassen Island (Lightfoot).

Described from Inaccessible Island, Tristan d'Acunha (Keytel (type) and others) and also recorded from Gough Island.

Type in British Museum.

Jaw arcuate, consisting of numerous loosely arranged fibres; radula with about 230 teeth in each row, central unicuspid, minute, inner laterals almost unicuspid, a small inner cusp appearing about VOL. XXXIII.

No. 35 and later an ectocone, which eventually divides, the marginals having 4 or 5 small equal cusps.

This species was long known in collections under the name of *M. nigra* Phil., a synonym of *pepita* King, from South America, which it closely resembles, but its early whorls are rather less convex and the small columellar fold is, on the average, slightly more pronounced than in King's species. The South African examples appear to differ slightly from type, but are not in sufficiently good condition for their possible distinctness to be determined; I am not certain that any were collected alive.

# Subfamily Melampodinae.

Shell obconic to ovate, aperture narrow, with one fold on columella and usually smaller folds above it; foot-sole divided by a transverse groove; radula with unicuspid central and lateral teeth, marginals with small ectocones in addition to the larger mesocone; nervous system with visceral ganglia close together; vas deferens separating from female duct a long way above the female opening; vagina very long, penis also long.

Genus Melampus Montfort, 1810
(Conch. Syst., ii, p. 319).

Type Bulimus coniformis Brug. (Voluta coffea Lin.)

(= Conovulus Lam., 1812, etc.).

Shell solid, ovate or inversely pyriform, spire rather short, teeth of radula with fairly large mesocones, marginals with additional small outer cusps.

Pending expert revision of this puzzling genus, I prefer to retain for the South African species, where doubt exists as to their relationship, names originally applied to African forms, not dealing with the difficult question of possible synonymy except in cases where it can be fully established.

# (i) Section *Melampus* s.s. Shell practically smooth.

Microscopic investigation shows that well-preserved examples of certain species have punctate spiral engraving on the early post-apical whorls, which becomes less apparent on the later and is usually invisible below the periphery; the omission of this feature from any of the following descriptions does not necessarily imply that it does not exist, but that the shells available for examination are not fresh enough to show it.

# Melampus lividus (Desh.).

#### Ref. List No. 478.

1830. Auricula livida Desh., Enc. Méth. Vers., ii, p. 91. D.

1844. " Küst., Conch. Cab., p. 44, pl. vi (1843), f. 21. D.F.

1847. Auricula livida Desh., Lovén, Ofvers. Kgl. Vet.-Ak. Förhandlingar, Stockholm, p. 190, pl. iii. R.

1880. Melampus lividus Desh., Crosse & Fisch., Miss. au Mexique, ii, p. 14. R.

1921. Melampus lividus Desh., Germ., Faune Mascareignes, p. 240. D.

Shell of fair size, acuminate ovate, almost imperforate, smooth, glossy, bluish white or brownish, sometimes showing a few faint brown bands and typically, though not constantly, with a chestnut patch on the base. Spire rectangularly conic, sides scarcely convex, apex mamillate. Whorls 9-10, nearly flat above, apical smooth, next 3 engraved with 2 spiral dotted lines, which are barely visible on the remainder, aperture narrow, nearly vertical, with normally 3 low plaits on the paries and 1 on the columella, labrum simple, with from 5 to 7 transverse internal ridges.

Long. 13.8, lat. 7.5; apert. alt. 10.4, lat. 2.8; last whorl 12.0 mm., but the species attains dimensions of 18 × 11 mm.

Hab. NATAL. Mouth of Umlaas River (Krauss; Burnup); ? juv. in Durban Bay (Burnup).

Also known from Mauritius (type), Reunion, Mayotte, Seychelles, etc.

Specimens ex auct. in École des Mines, Paris.

# var. fasciata Küst.

1844. Auricula livida Desh., var. fasciata Küst., Conch. Cab., p. 45, pl. vi (1843), f. 26. D.F.

Background corneous yellow with 3 narrow bluish bands on last whorl and chestnut patch on base; spire darkish blue, labrum dirty white.

#### var. ovata Küst.

1844. Auricula livida Desh., var. ovata Küst., ibid., p. 45, pl. vi (1843), f. 24–25. D.F.

Elongate ovate, spire broadly conical with acute apex, background ochre-yellow, spire brown-red, last whorl below periphery corneous brown, with chestnut patch on base, labrum brown-red.

var. caerulea Küst.

1844. Auricula livida Desh., var. caerulea Küst., ibid., p. 45, pl. vi (1843), f. 22–23. D.F.

Smaller than type, somewhat elongate, dark copper-blue, spire purple, basal patch dark chestnut, labrum blackish.

Hab. of above varieties, NATAL coast (Krauss).

Melampus umlaasianus (Küst.).

(Pl. xv, f. 28-29.)

Ref. List No. 482.

1844. Auricula umlaasiana Krs., Küst., Conch. Cab., p. 43, pl. vi (1843), f. 16–18. D.F.

Shell of fair size, broadly acuminate ovate, imperforate, smooth, glossy, buff with 5 brown bands, several of which are sometimes confluent. Spire rectangularly conic, sides scarcely convex, apex acutely mamillate. Whorls 8-9, flat above, 2nd and later engraved with 2 spiral dotted lines, which gradually weaken, and are absent below the periphery, which is very obscurely angulate and proportionally broader than usual; aperture narrow, somewhat oblique, with 3 weak plaits on the paries and 1 stronger on the columella, emerging to the margin, labrum simple, with from 6 to 8 inset transverse ridges.

Long. 11, lat. 6.5, apert. 8.5 mm.

Hab. NATAL. Mouth of Umlaas River (Krauss). Type in Stuttgart Museum.

var. obscura Küst.

1844. Auricula umlaasiana Krs., var. obscura Küst., ibid., p. 44, pl. vi (1843), f. 19–20. D.F.

Dull brown or brownish yellow, darker on spire. Topotypes which appear to represent this variety are unbanded and measure

Long. 12.0, lat. 7.3; apert. alt. 9.1, lat. 2.0; last whorl 11.2 mm.

Hab. NATAL. Mouth of Umlaas River (type, Krauss); Isipingo (Burnup).

Melampus caffer (Küst.).

(Pl. xv, f. 20-22.)

Ref. List No. 476.

1844. Auricula caffra Küst., Conch. Cab., p. 36, pl. v (1843), f. 7. D.F.

1921.  $Melampus\ caffer\ K$ üst., Germ., Faune Mascareignes, p. 247. D.

Shell of fair size, ovate, subrimate, smooth, glossy, deep buff, with 2 broad chestnut bands, one extending from the periphery to the upper suture and colouring the entire spire, the other towards the base, usually with a white zone above and

beneath, and sometimes a brown spot on base. Spire short, convex conoid. Whorls 7, smooth but for weak growth striolation, flat above, the last broadest a little above the middle; aperture narrow, nearly vertical, with 3 low parietal plaits, the middle slightly strongest and upper sometimes absent, columellar fold of medium size, emerging to the margin, labrum simple, with from 4 to 7 (usually 5 or 6) white transverse ridges.

Long. 13.2, lat. 8.8; apert. alt. 10.2, lat. 2.3; last whorl 12.6 mm.

Hab. NATAL. Mouth of Umlaas River (type, Krauss).

Type in Stuttgart Museum.

Widely distributed throughout Oceania; the record of Rikatla in my Reference List refers to the next species.

Melampus küsteri (Küst.).

(Pl. xv, f. 24–25.)

Ref. List No. 477.

1842. ?? Auricula monile Lam., Rve., Conch. Syst., ii, p. 106, pl. clxxxvii, f. 8. F.

1844. Auricula küsteri Krs., Küst., Conch. Cab., p. 34, pl. iv (1843), f. 10–11. D.F.

1925. Melampus caffer Küst., Conn., Trans. R. Soc. S. Africa, xii, p. 187. L.

Shell of medium size, acuminate ovate, smooth, glossy, carneous yellow or grey with broad unequal brown bands. Spire rectangularly conic, sides nearly straight, apex mamillate. Whorls 9, nearly flat above, aperture vertical, with 2 parietal plaits, lower inclined to be duplicate, columellar fold small, labrum simple, with 6-7 immersed transverse ridges. The largest specimen in coll. Krauss measures  $13.7 \times 8$ , apert. 10 mm.

Hab. NATAL. Mouth of Umlaas River (type, Krauss).

LORENZO MARQUES. Rikatla (Junod).

Type in Stuttgart Museum.

var. oblonga Küst.

(Pl. xv, f. 26-27.)

1844. Auricula küsteri Krs., var. oblonga Küst., ibid., p. 34, pl. iv (1843), f. 12–13. D.F.

1925. Melampus küsteri Krs., var. oblonga Küst., Conn., Trans. R. Soc. S. Africa, xii, p. 188. L.

More slender and elongate than type, with higher spire; the parietal plaits are stated to be connected by a raised callus, but this is not usually the case.

The larger of the type pair measures  $16 \times 8$ , apert. 12 mm.

Hab. NATAL. Mouth of Umlaas R. (Krauss).

LORENZO MARQUES. Estuary of Komati R., Rikatla (Junod).

Type in Stuttgart Museum.

# Melampus ordinarius M. & P.

(Pl. xv, f. 20.)

Ref. List No. 480.

1901. Melampus ordinarius M. & P., A.M.N.H., viii, p. 321, pl. ii, f. 14. D.F.

Shell small, acuminate ovate, smooth, glossy, pale straw. Spire rectangularly conic, sides straight, apex mamillate. Whorls 9, flat above, engraved, after the 1st, with 2 or 3 irregularly spaced spiral dotted lines, which are nearly absent below the bluntly angulate periphery; aperture oblique, very narrow, with one plait more than half-way down the paries, a short horizontal columellar fold and 3 or 4 transverse ridges within the simple labrum.

Long. 9-1, lat. 5-4; apert. alt. 5-9, lat. 1-2; last whorl 7-9 mm.

Hab. NATAL. Mouth of Umlaas River (Burnup). Type in British Museum.

#### Melampus acinoides Morel.

Ref. List No. 475.

1889. Melampus acinoides Morel., J. de C., xxxvii, p. 14, pl. i. f. 9. D.F.

1915. Melampus acinoides Morel., Bartsch, Bull. U.S. Mus., xci, pp. 10, 221. L.

1915. Microtralia sp.?, Bartsch, ibid., p. 10. L.

1932. ambigua Turton, Marine Shells of Port Alfred, p. 9, pl. ii, f. 73. D.F.

1932. Melampus acinoides Morel., Turton, ibid., pp. 8, 295. N.L.

Shell very small, subfusiform, imperforate, smooth, glossy, yellow-brown. Spire rectangularly conic, apex mamillate. Whorls about 6, flat above, practically smooth, the last evenly curved on each side; aperture narrow, vertical, with 2 horizontal parietal plaits, the lower much stronger, columellar fold horizontal, in the situation of a third parietal plait, labrum simple, edentate.

The shell described, from Kalk Bay, is absolutely typical, but slightly fresher

and better grown than any of the type set; it measures

Long. 5.0, lat. 3.0; apert. alt. 3.2, lat. 1.2; last whorl 4.9 mm.

Hab. CAPE PROVINCE. Zwartkops River, Port Elizabeth (type, Crawford); Port Alfred (acinoides and ambigua, Turton); Kowie R. (Kincaid); Estuary of Keurbooms R., Plettenberg Bay (Barnard).

CAPE PENINSULA. Kalk Bay (Lightfoot).

Type of acinoides in British, ambigua in Oxford Museum.

Turton states (l.c., p. 295) that acinoides was not described from South Africa; this is of course an oversight, I do not think it has yet been collected outside the Cape Province. Tomlin agrees with me that Microtralia ambigua is simply the nepionic stage of acinoides; it measures  $1.2 \times 0.8$  mm. and is covered with the strong spiral grooves typical on very immature examples of the genus, which fade away on the later whorls of older shells, but are still visible about the apex of well-preserved specimens of *acinoides*.

# Melampus parvulus Pfr.

(Pl. xv, f. 23.)

Ref. List No. 480.

1854. Melampus parvulus Nutt., Pfr., Mal. Blätt., i, p. 147 (without characters).

1856. Melampus parvulus Nutt., Pfr., Mon. Auric., p. 24. D.

1875. , *dupontianus* Morel., J. de C., xxiii, p. 25, pl. i, f. 2. *D.F.* 

1921. Melampus parvulus Nutt., Germ., Faune Mascareignes, p. 249. D.

Shell small, acuminate ovate, varying in breadth, practically imperforate, smooth, glossy, dull brown, usually with a buff band, of varied width, at top of last whorl, but not extending to the suture. Spire more or less rectangularly conic, sides nearly straight, apex acutely mamillate. Whorls 9, nearly flat above, 3rd and 4th showing 2 spiral lines of punctured dots, which are not apparent on the others, scarcely angulate at periphery. Aperture narrow, nearly vertical, with usually 2 small plaits, close together, near bottom of paries, and a strong horizontal columellar fold extending to margin, labrum simple, furnished with from 2 to 6 immersed white transverse ridges. The shell figured, from Mauritius, measures

Long. 8.2, lat. 5.0; apert. alt. 5.6, lat. 1.5; last whorl 7.1 mm.

Hab. NATAL. Durban Bay; mouths of Umlaas and Umkomaas Rivers (Burnup).

CAPE PROVINCE. Kowie (fide Kincaid).

Described from Oahu and widely distributed from Oceania through the Mascarene Is. to East Africa; *M. dupontianus* Morel. is entirely inseparable from the typical form, as is the Natal race. As far as can be judged from the wretched type set of *zealandicus* H. & A. Ad., this species is identical with *parvulus*, in which case the name would have priority.

Type of parvulus in coll. Pfeiffer, originals in British Museum; types of dupontianus and zealandicus in British Museum.

This species varies much in contour and the number of labral ridges in sets from the same locality, but the 2 small parietal plaits, so close together near the base, provide some faint guide for its determination.

## Melampus acutispira Turton.

(Text-fig. 40.)

1932. Melampus acutispira Turton, Marine Shells of Port Alfred, p. 9, pl. ii, f. 72. D.F.

The type set of this species contains two shells, of which the larger is a small, beach-rolled, colourless, sculptureless shell, slightly broader than ordinarius, but similar in contour to the obese form of umlaasianus, of which it is probably the young. 6 whorls, shouldered at periphery, apical strongly mamillate, as in umlaasianus, while the second of the type pair, a minute example under 2 mm. in length, is covered with very fine and close microspiral engraving, a feature which appears to exist also in the apical whorls of Küster's species. The type has a strong columellar fold and 2 close together a short way above it, the upper the longer, and another, smaller, a short way above this, while under a microscope there are signs of 2 or 3 more very weak, probably evanescent processes; there are also 5 equidistant folds inside the labrum.

Alt. 5.5, lat. 3.4; apert. alt. 4.0, lat. 0.9; last whorl 4.6 mm.



Text-fig. 40.—Melampus acutispira Turton. Type pair in Oxford Museum; ×2.

Hab. CAPE PROVINCE. Port Alfred (Turton).

Type in Oxford Museum.

Until immature specimens of umlaasianus of the same size can be compared with the Turton infant it may be wiser not to embark on the troubled sea of possible synonymy.

(ii) Section Signia A. Ad., 1855.

(Gen. Rec. Moll., ii, p. 245).

Shell with fairly strong, usually decussate sculpture.

Melampus semiaratus Conn.

Ref. List No. 481.

1898. Melampus granifer Mouss., M. & P., Proc. Mal. Soc., iii, p. 180. L.

1912. Melampus semiaratus Conn., Ann. S.A. Mus., xi, p. 228, pl. ii, f. 8. D.F.

1925. Melampus semiaratus Conn., Trans. R. Soc. S. Africa, xii, p. 187. N.L.

Shell small, conic ovate, subrimate, rather glossy, uniform dark brown. Spire rectangularly conic, apex acute. Whorls 6, flat above, upper and lower portions engraved with spiral grooves which are crossed by faint transverse striae, middle usually smooth, but sometimes spirally grooved. Aperture long and narrow, with 3 sharp, almost equidistant plaits on the paries, a medium-sized columellar fold, and a single white internal rib half-way up the simple labrum.

Long. 9.6, lat. 5.5; apert. alt. 7.5; last whorl 8.8 mm.

Hab. NATAL. Durban Bay; mouths of Umlaas and Umkomaas Rivers (Burnup); Isipingo (Cawston).

LORENZO MARQUES. Estuary of Komati River (Junod).

Type in British Museum.

I have recorded this species in 1928 from Italian Somaliland, and am inclined to unite it with M. striatus Pse., and possibly with semisulcatus Mouss. (which is unknown to me), both having been described from Oceania, but until wider knowledge is available it may perhaps be advisable to retain the present name for the East African race of highly sculptured Melampus.

#### TRIBE HYGROPHILA.

Inhabitants of fresh water, with thin, corneous, unicoloured shells, dextral or sinistral, of all shapes and sizes, animal with smooth skin, tentacles tapering, cylindrical or compressed, genital orifices separate but united by a groove.

The distribution and supply of many of the species appears to have undergone considerable modification of late years, a fact to which I can testify from the class of freshwater molluscs that now pass through my hands, compared with those of twenty years ago, and a recent paper by Cawston \* gives such an interesting explanation of the causes which have influenced it that I make no apology for quoting it here: "The collection of pond-snails during the last few years has been handicapped by the lessened rainfall in many districts in the mountainous parts of the Union and by anti-malarial measures which have been adopted in coastal areas, whereby small collections of water have been treated with chemicals and much of the vegetation on which pond-snails breed has been destroyed.

"Prolonged drought has occasioned the death of rushes and the larger water plants in mountainous marshes, so that the streams now contain smaller weeds on which one is more likely to find such small molluscs as Ancylidae and Lymnaea truncatula, instead of Bulinus, Lymnaea natalensis, and Physopsis africana, which may be expected

<sup>\*</sup> Trans. R. Soc. S. Africa, xxii, 1934, p. 81.

along the banks of rivers containing the large rush, Cyperus immensus C. B. Clark.

"Following a snowstorm in Southern Basutoland in 1902 there has been a disappearance of the wild olive, and fuel has become a constant problem in this mountainous district. A similar experience is noted in the Transkei, where the Yuka River was once characterised by its beautiful indigenous trees, but is now obvious by the absence of tree life.

"Pond-snails favour shady portions of shallow water, and the absence of rains has recently discouraged the breeding of all but those which are largely dependent on light, such as Lymnaeae and Ancylidae. Ancylidae can resist desiccation for several weeks by attaching themselves to a rush; Lymnaeae are dependent on light, and it has not yet been clearly shown how they can resist desiccation; burying would seem to kill them, and it is difficult to find them amid the dry mud of shallow pools. As the return of rains is accompanied by numerous small examples of a species, it would seem that it is the young examples or even the egg-masses that survive a winter drought.

"We have reason to believe, then, that the environmental influences to which pond-snails have been exposed in the Union during the last few years have been detrimental to the breeding of *Physopsis africana* Krauss, *Bulinus tropicus* (Krauss), *Lymnaea natalensis* Krauss and allied species, and that the shortage of rainfall and consequent increase of marsh land in the mountainous districts has favoured the breeding of smaller species such as *Lymnaea truncatula* (Müller), a well-known carrier of Fasciola infection."

Owing to some of these snails serving as intermediate hosts to the germ of the *Bilharzia* disease, a regular spate of literature dealing to more or less extent with them has arisen during the last twenty years in various medical publications. Much of it is conchologically erroneous and much more of comparatively little interest from a conchological viewpoint; I have therefore omitted from the following references all which do not fulfil in some particular the last-mentioned condition.

#### FAMILY PHYSIDAE.

Shell spiral, sinistral, thin, usually smooth and glossy, spire more or less produced. Animal sinistral, tentacles slender, no pseudobranch, foot narrow, pointed behind. Jaw single, arcuate, radula with numerous teeth in oblique rows, slanting upwards from the margins, central tooth relatively wide, multicuspid, laterals and marginals

similar to each other, obliquely bent, pectinate, with a peculiar process projecting forward from their external angle.

The generic classification of this family depends to a great extent on whether the mantle lobes of the animal overlap the shell or not, and as these have not been mentioned in the descriptions of either of the two species yet described from tropical Africa, I leave that which follows where it was placed by Clessin, in Physa sensu lato, without anatomical detail.

> Genus Physa Drap., 1801 (Tabl. Moll., Fr. p. 52). Type Bulla fontinalis Lin. Physa mosambiquensis Cless. (Text-fig. 41.)

1886. Physa mosambiquensis Cless., Conch. Cab., p. 366, pl. liv, f. 4. D.F.

1925. Physa mosambiquensis Cless., Conn., Trans. R. Soc. S. Africa, xii, p. 189. N.F.

"Shell narrow ovate, hardly rimate, smooth, glossy, transparent, corneous yellow. Spire short, fairly acute. Whorls 4, elongate, little convex, rapidly increasing, last 2rds to 4ths of total length; suture little impressed. Aperture narrow piriform, acuminate above, peristome thin, acute, ends not united, columella thin, little contorted"; the first 2 whorls are Text-fig. 41. practically smooth, remainder showing faint, straight growth Physa mosambistriolae.



censis Cless.

Specimen in Berlin Museum;  $\times 2.$ 

"Long. 7.5, lat. 4 mm."

Hab. LORENZO MARQUES. Tette (Peters). Type in Berlin Museum.

#### FAMILY LYMNAEIDAE.

Animal and shell usually dextral, head with broad, short snout, tentacles triangular and flat, no pseudobranch, foot rather short; jaw with an accessory piece on each side, central tooth of radula narrow, its cusp small, single or asymmetrically double, laterals with outer and often with inner accessory cusps, marginals with long cusps, united except at their extremities, which tend to be pectinate owing to the splitting of the endocone and sometimes of the ectocone.

Subfamily LYMNAEINAE.

Shell spirally coiled.

Genus Lymnaea Lam., 1799 (Mem. Soc. Hist. Nat. Paris, p. 75, as Lymnoea). Type Helix stagnalis Lin.

Shell ovate or elongate, rimate or imperforate, aperture oval, peristome thin and simple, mantle not extending over the shell; anatomy as in family.

Subgenus Radix Montf., 1810 (Conch. Syst., ii, p. 266). Type Helix auricularia Lin.

Shell of fair size, thin, ovate, spire small, last whorl and aperture large, columella usually obliquely folded; upper section of penis long and slender.

## Lymnaea natalensis Krs. Ref. List No. 491.

1848. Limnaeus natalensis Krs., Südafr. Moll., p. 85, pl. v, f. 15. D.F.

1917. Limnaea natalensis Krs., Cawst., Med. J. S. Africa, xii, pp. 183, 184, f. 5–6. N.F.

1919. Limnaea (Radix) natalensis Krs., Germ., Bull. Mus. Paris, pp. 47, 179. D. Synonymy.

1920. Limnaea (Radix) natalensis Krs., Germ., Voy. Babault, p. 129. D.

1921. Limnaea natalensis Krs., Cawst., Trans. R. Soc. S. Africa, xi, p. 301.  $\,N.\,$ 

1925. Limnaea natalensis Krs., Conn., Trans. R. Soc. S. Africa, xii, p. 188. N.

1925. Limnaea natalensis Krs., Kay Sharp, Schistosomiasis, p. 12. D.F.R.

1925. Limnaea natalensis Krs., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. F.R.

1925. Limnaea natalensis Krs., Cawst., Ann. Trop. Med. Paras., xix, p. 217, f. 7. F.

1925. Limnaea natalensis Krs., Cawst., Trans. R. Soc. S. Africa, xiii, p. 40, pl. iv, f. 2. N.F.R.

1925. Limnaea natalensis Krs., Cawst., J. Austral. Vet. Ass., i, p. 65.  $\,R.\,$ 

1926. Radix aff. natalensis Krs., Wenz., Diam.-Wüste S.-W.-A., ii, p. 158. N.L.

1926. Limnaea (Radix) natalensis Krs., Germ. & Nev.-Lem., Ann. Parasit., iv, p. 355. D.F.

1927. Limnaea natalensis Krs., Cawst., Ann. Trop. Med. Paras., xxi, p. 36, pl. v, f. 1–2. N.F.

1927. Limnaea natalensis Krs., Cawst., J. Med. Ass. S. Africa, i, p. 309. N.F.

1927. Lymnaea natalensis Krs., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 110, pl. xi, f. 3. N.F.

1928. Lymnaea natalensis Krs., Beq., Amer. J. Trop. Med., viii, p. 220. N.

1929. Limnaea natalensis Krs., Cawst., Trans. R. Soc. Trop. Med. Hyg., xxii, p. 335. N.

1929. Limnaea natalensis Krs., Le Roux, 15th Rept. Vet. Serv. U.S. Africa, pp. 408, 437, f. 27–31. N.F.

1929. Lymnaea (Radix) natalensis Krs., Faust, Human Helminthology, p. 566. N.R.

1930. Lymnaea natalensis Krs., Conn., Ann. S.A. Mus., xxix, p. 309. N.

1930. Limnaea natalensis Krs., Cawst., Trans. R. Soc. S. Africa, xviii, p. 325.  $\,R.\,$ 

1932. Lymnaea natalensis Krs., Blackie, Mem. London Sch. Trop. Med., v, p. 33, pl. i, f. 8. N.F. Eggs.

1933. Limnaea (Radix) natalensis Krs., Germ., Bull. Mus. Paris, p. 139. D.L.

1936. Radix natalensis natalensis Krs. (=damarana Bttg.), Haas, Abh. Senckenb. Ges., No. 431, p. 23. N.L.

Shell medium to large, acuminate oval, minutely rimate, thin, smooth, transparent, corneous yellowish olivaceous. Spire very short, acute. Whorls 4, convex, rapidly increasing, last comprising nearly the entire shell, sculptured after the apex with very fine, close, faint vertical striolae, with very occasional longitudinal puckers, as though crossed by coarse spiral grooves; suture well defined. Aperture large, acuminate ovate, broadly rounded at base, peristome simple, acute, columella long, vertical, slightly concave and twisted, margin narrowly adnate, completely obscuring the rima except at its extreme base.

Alt. 15.0, lat. 9.2; apert. alt. 11.0, lat. 6.1; last whorl 13.5 mm.

Hab. NATAL. "Common" (Krauss); an unusually large form is known from the Botanical Gardens, Durban.

TRANSVAAL. Pretoria District (common); Zoutpansberg (Cregoe); Bodtchabelo, near Middelburg (Junod); Klerksdorp; Lake Chrissie; Mulders Drift; Magaliesberg; Rustenburg; Scheerpoort (Cawston); Pietersburg (Farquhar); Krüger Park (Haas).

ORANGE FREE STATE. Valsch R., Lindley; Rhenoster R.,

near Heilbron (Connolly); Kroonstad (Eckersley); Mazelspoort, near Bloemfontein (Cawston).

CAPE PROVINCE. Port Elizabeth (Crawford); Humansdorp (Le Roux); Mossel Bay (Power); Brand Vlei, Worcester (Barnard).

GRIQUALAND WEST. Postmasburg (Power); Newlands; Vaal and Modder Rivers near Kimberley (Miss Wilman).

BRITISH BECHUANALAND. Lake Ngami (Woosnam).

S. RHODESIA. Victoria Falls (Connolly); widely distributed (Blackie).

KAOKOVELD. Kamanyab (subfossil, Barnard).

NAMIB. 20 km. east of Bogenfels (eocene, Kaiser & Beetz).

LORENZO MARQUES. Itschongove (fide Martens); Lebombo Marsh, Rikatla (a small acuminate form); L. Mhandlen; Makulane (Junod).

Type in Stuttgart Museum.

The shell described, from Umbilo, practically coincides with type, but the species attains far greater size and varies greatly in length of spire and size of aperture, while the labrum, instead of gradually descending, often ascends slightly at its upper extremity. The largest example examined from Durban contains 5 whorls and measures

Long. 24.6, lat. 14.7; apert. alt. 20.0, lat. 10.0; last whorl 22.3 mm., while series from Sydenham, Natal and Rustenburg are nearly as large.

The sculpture of this species usually lacks almost all trace of the puckering mentioned in my description, an important point, since the invariable presence of strong, frequent puckers is the sole feature which separates from it the Central African *L. elmeteitensis* Smith, which is probably hardly varietally distinct, a remark that applies to the so-called species which follows.

# Lymnaea caillaudi Bgt.

Ref. List Nos. 489, 490.

1883. Limnaea caillaudi Bgt., Ann. Sci. Nat. Zool., xv, p. 89, pl. x, f. 100–101. D.F.

1883. Limnaea africana Rüpp., Bgt., ibid., p. 95, pl. x, f. 99. D.F., ,, acroxa Bgt., ibid., p. 90, pl. x, f. 94. D.F.

,, alexandrina Bgt., ibid., p. 92, pl. x, f. 95–96. D.F.

1888. , lavigeriana Bgt., Icon. Moll. Tanganika, pl. i, f. 18–19. F.

1888. Limnaea laurenti Bgt., ibid., pl. i, f. 21-22. F.

- 1889. Limnaea kynganica Bgt., Moll. Afr. Équat., p. 158. D., , , zanzibarica Bgt., ibid., p. 158. D.
- 1898. *Limnaeus dakaensis* Stur., S.A. Moll., p. 74, pl. iii, f. 55-56. *D.F.*
- 1908. Limnaea africana Rüpp., N. & A., Ann. Sci. Nat. Zool., viii, p. 261. D.F.
- 1909. Limnaea cailliaudi Bgt., Plry., Mem. Inst. Égypt. vi, p. 46, pl. iii, f. 36-38. N.F.
- 1910. Limnaea damarana Bttg., Abh. Senckenb. Ges., xxxii, p. 450, pl. xxviii, f. 16. D.F.
- 1919. Limnaea africana Rüpp. (=cailliaudi, alexandrina, laurenti, lavigeriei, acroxa, kynganica, and zanzibarica Bgt.), Germ., Bull. Mus. Paris, pp. 181, 185. N.
- 1920. Limnaea africana Rüpp., Germ., Voy. Babault, p. 141, pl. iv, f. 6-11 and text-figs. 31-59. D.F. and Synonymy.
- 1927. Lymnaea (Radix) caillaudi Bgt. (=africana "Rüpp." etc.), Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 113. N.
- 1930. Lymnaea caillaudi Bgt., Conn., Ann. S.A. Mus., xxix, p. 310. N.
  - 1930. Lymnaea damarana Bttg., Conn., ibid., p. 310. N.
- 1932. ,, caillaudi Bgt. (= dakaensis Stur.), Blackie, Mem. London Sch. Trop. Med., v, p. 33, pl. i, f. 9. N.F.
- 1936. Radix natalensis dakaensis Stur., Haas, Abh. Senckenb. Ges., p. 23. N.L.

In its most extreme form the shell differs to a marked extent from typical natalensis in being far more slender, with far longer spire and comparatively shorter aperture, but practically every intermediate grade can be found, often in series from the same locality.

The typical sculpture is that of typical natalensis, with little puckering; local races in which this feature is more pronounced are referable to L. elmeteitensis Smith, but I have not observed any such in South Africa. An example from Umbilo, with 4 whorls, measures

Alt. 16·0, lat. 8·3; apert. alt. 10·0, lat.  $5\cdot6$ ; last whorl  $14\cdot0$  mm., while a typical example of *natalensis* from Rustenburg with nearly 4 whorls and about the same length measures

Alt. 16.5, lat. 11.0; apert. alt. 14.0, lat. 7.3; last whorl 15.2 mm.

Although neither represents the extreme form of either species, the discrepancies between their dimensions might be considered to afford ample justification for their separate specific existence, were it not that it is quite impossible to differentiate between the more commonly found intermediates of either.

Germain selected africana as the prior name to apply to this group, on the ground that Bourguignat (1883) mentions it on p. 85 of his paper, before *caillaudi* and others, but Pilsbry and Bequaert point out that its occurrence thereon is *nomen nudum*, so that *caillaudi*, as the first species actually described, has priority.

Sturany likens his dakaensis to lavigeriana Bgt., which Germain attributes to caillaudi; it appears to fall well within the limits of that species. The description of damarana Bttg. applies entirely to caillaudi, but the original figure bears so little resemblance to any known form that I sent a large selection of African Lymnaea shells to Dr. Haas for comparison with the unique type, and he informs me that it agrees well with specimens of caillaudi from the Omuramba-Omataka River, and can be placed in synonymy.

Hab. NATAL. Umbilo (Porter).

CAPE PROVINCE. Baakens R., Port Elizabeth; Grobelaars R., Oudtshoorn (Porter); Zwartkops (Cruden).

S. RHODESIA. Daka (dakaensis, Penther); near Salisbury (Blackie); Mtoko, between Salisbury and Tette (Haas).

OVAMBOLAND. Upper reaches of Omuramba-Omataka R. (Shortridge).

DAMARALAND. Gobabis (damarana, subfossil, Hermann).

Type of dakaensis in Vienna, damarana in Senckenberg, type or paratypes of Bourguignat's species in Geneva and Paris Museums.

Though rather infrequent in South Africa, this narrow, long-spired form is widely diffused further north, Bourguignat having described his "species" cited above from Egypt, Abyssinia, Tanganyika, etc., while others not included are probably synonymic.

My list of references includes only those of greatest importance; fuller particulars will be found in Germain's articles of 1919 and 1920.

Subgenus Galba Schrank, 1803 (Fauna Boica, iii, pp. 262, 285). (= Fossaria Westld., 1885).

Type  $Galba\ pusilla\ Schrank\ (=Buccinum\ truncatulum\ Müll.).$ 

Shell small, turreted, columella usually without a fold; upper section of penis shorter than the lower.

Certain authors repudiate Galba on the ground that G. pusilla was undoubtedly a young shell, and that in the absence of a type it is impossible to ascertain just what species it might have been; but in 1833 \* Fitzinger, usually a reliable author, stated definitely, albeit dogmatically, that pusilla and truncatula are conspecific, listing in

<sup>\*</sup> Beitr. Landesk. Oesterr., iii, p. 113.

the old-fashioned style Limnophysa minuta mihi (Helix limosa Linné; Buccinum truncatulum Müller; Helix truncatula Gmelin; Buccinum truncatulum and Galba pusilla Schrank; Limnaea minuta Lamarck; Limneus minutus Drap., Studer and Hartmann; Limnaeus minutus Pfeiffer; Limneus longulus Ziegler); and it appears to me that a definite statement such as this cannot be ignored by persons who cannot explain the grounds on which it was based. Even if the type of pusilla cannot now be traced, there is no reason why Fitzinger should not have been acquainted with it, or even with its author, as Schrank (1747–1835) lived in Bavaria and Fitzinger (1802–1884) in Austria, so there was ample time and probably opportunity for the two authors to have met one another and discussed the true status of Schrank's species before the publication of Fitzinger's work.

# Lymnaea truncatula (Müll.).

(Pl. xv, f. 16.)

#### Ref. List No. 493.

1774. Buccinum truncatulum Müll., Verm., ii, p. 130. D.

1789. Bulimus truncatus Brug., Enc. Méth. Vers., i, p. 310. D.

1801. Limneus minuta Drap., Tabl. Moll. Fr., p. 51. D.

1803. Helix fossaria Mont., Test. Brit., ii, p. 372, pl. xvi, f. 9. D.F.

1862. Limnaeus umlaasianus Küst., Conch. Cab., p. 32, pl. vi, f. 4-5. D.F.

1916. Limnaea truncatula Müll., Conn., Ann. S.A. Mus., xiii, p. 189. N.

1926. Limnaea (Galba) truncatula Müll., Germ. & Nev.-Lem., Ann. Parasit., iv, p. 357. D.F.

1927. Limnaea truncatula Müll., Cawst., Ann. Trop. Med. Parasit., xxi, p. 36, pl. v, f. 4. N.F.

1929. Limnaea truncatula Müll., le Roux, 15th Rept. Vet. Serv. S. Africa, p. 437, f. 34-36. F.

1929. Lymnaea (Galba) truncatula Müll., Faust, Human Helminthology, p. 566. N.R.

1932. Galba truncatula Müll., Mehl, Arb. Bayer. Landesamt, x, p. 1, pls. ii, xii, xvi-xxii. F. Ecology.

Only recent references of local or particular importance are cited above.

Shell small, acuminate ovate, normally rimate, thin, smooth, semi-transparent, rather dull, corneous brown. Spire moderately produced, sides regular, apex subacute. Whorls about 5, convex, rapidly increasing, 1st smooth, remainder VOL. XXXIII.

sculptured with fairly strong and regular, close vertical striae, divided into regular spiral rows of longish puckers, as described under natalensis; suture simple, well defined. Aperture acuminate ovate, labrum nearly straight and vertical in profile, columella erect, sometimes prolonged across paries in a thick white callus, margin very narrowly reflexed over the narrow rima. A Heidelberg example measures

Alt. 7.8, lat. 4.4; apert. alt. 4.2, lat. 2.3; last whorl 5.8 mm.

Hab. NATAL. Umlaas River (umlaasiana, in coll. Küster; Cawston).

TRANSVAAL. Heidelberg; Mooi R., Potchefstroom (Cawston); Pretoria (McBean).

BASUTOLAND. Schzabathebe (Cawston).

CAPE PROVINCE. Stellenbosch (Péringuey); Seven Weeks Poort, Ladismith, stream below Cango Caves (Barnard).

BECHUANALAND. Hope Vlei, near Vryburg (subfossil in recent limestone, Rogers). Tlapings Laagte Well, west of Vryburg (subfossil, Rogers).

Type ubi?

### Lymnaea subtruncatula O. Bttg.

#### Ref. List No. 492.

1910. Limnaea subtruncatula Bttg., Abh. Senckenb. Ges., xxxii, p. 451, pl. xxviii, f. 17. D.F.

1926. Galba (Galba) aff. truncatula Müll., Wenz, Diam. Wuste S.-W.-A., ii, p. 158. N.L.

1930. Lymnaea subtruncatula Bttg., Conn., Ann. S.A. Mus., xxix, p. 311.  $\,N.$ 

Shell described as small, rimate, spire produced, sides moderately convex, apex subacute. Whorls 5, fairly convex, striatulate, columella strongly and peculiarly twisted, margin slightly expanded over the rima.

Alt.  $5\frac{1}{2}$ , lat. 3; apert. alt. 3, lat. 2; last whorl  $4 \cdot 1$  mm.

Hab. DAMARALAND. Gobabis (subtruncatula, subfossil, Hermann).

NAMIB. 20 km. east of Bogenfels (Eocene, Kaiser & Beetz).

Type apparently lost.

Böttger separated this species from truncatula mainly on account of its strongly twisted columella, a very unusual feature in Müller's species, but emphasised in a long series in my collection from Merton, England. If, therefore, this is the only ground for distinction, it does not appear sufficient for that purpose. Dr. Haas kindly informs me that he had arrived at this conclusion independently of myself, but until topotypes come to hand it is advisable to let Böttger's species stand.

#### FAMILY PLANORBIDAE.

Shell varying greatly in form; animal sinistral; tentacles slender, cylindrical; a lobe on the inner side of the mantle-opening forms a projecting pseudobranch; foot rather short; jaw with 2 lateral accessory plates as in the Lymnaeidae, but central tooth of radula not so narrow, and as a rule symmetrically bicuspid; laterals with at least 3 cusps; marginals usually with several denticles. Blood red, a most unusual feature which may possibly afford a clue to the preference which the Bilharzia worm evinces for members of this family in Africa and Southern Europe, rather than the Lymnaeidae and other white-blooded molluscs, for its temporary development, preparatory to taking up its sojourn in the red-blooded human being.

Subfamily Planorbinae.

Shell flat, coiled in a disc or plane.

Genus Biomphalaria Prest., 1910 (A.M.N.H., vi, p. 535). Type B. smithi Prest.

Shell discoidal; spire deeply sunk in centre, umbilicus large,\* whorls usually increasing rather rapidly, nearly always showing under a microscope spiral rows of minute vertical ridges; periphery broadly rounded, but the base usually shows a blunt angulation around the umbilicus and the upper surface sometimes shows a less distinct one; peristome receding strongly towards the base, and last whorl sometimes more or less deflected. Small or immature specimens may show folds a short distance within the aperture, namely, a slightly oblique, entering fold on about the middle of the penultimate whorl, with a small tubercle below it, and, within the outer lip, a radial fold below the periphery and about three horizontal folds above it, the top one being the smallest. In some species, however, specimens showing these internal folds have not yet been found, while in others they may be very rare. Pseudobranch simple; mantle-cavity with a single pair of longitudinal folds as in Bulinus, s.s.; kidney reflexed anteriorly; radula also of the same type as in that genus, the reflected part of the marginal teeth being long. Prostate gland consisting of an elongated cluster of rather large

<sup>\*</sup> I am regarding the shell as dextral in this and the two following genera, although the animal is sinistral.

acini; penis without an appendix or gland, its posterior part slender and containing a long and narrow, unarmed glans or verge.

The type of this genus is an aberrant species from Lake Edward, of which the anatomy is not yet known; but it is connected with the more normally shaped species by certain intermediate forms, and there can be scarcely any doubt that it is congeneric with "Planorbis" pfeifferi, etc., as suggested by Pilsbry and Bequaert (1927), although I do not agree with Haas (1936) that it is merely a subspecies of rüppellii Dkr. The name Biomphalaria Preston, 1910, should therefore be used for this genus in preference to Tropicorbis Pilsb. and Brown, 1914, or the still later Afroplanorbis Thiele, 1931, of which the type species occasionally shows internal folds in the young of exactly the same character as in pfeifferi, with which it is clearly congeneric.

This genus is widely distributed throughout Africa, and also in South and Central America, including, as it certainly does, the Neotropical species that have been assigned to *Tropicorbis*, and probably also those placed in *Australorbis* Pilsb., 1934 (*Planorbina* Dall, 1905, non Hald., 1843), though the latter may constitute a distinct subgenus. According to Pilsbry (1934) it is distinct not only from the Palaearctic genus *Planorbarius*, but also from the North America genus *Planorbula*, from which it differs in its male organs, notwithstanding the similarity of its shell. It is also very distinct from the genus *Planorbis*, even if this be regarded in a broad sense, so as to include as subgenera *Gyraulus* and other minor groups.

Biomphalaria pfeifferi (Krs.).

(Pl. xvi, f. 24, and text-fig. 42.)

Ref. List Nos. 498, 501, and 502.

1848. Planorbis pfeifferi Krs., Südafr. Moll., p. 83, pl. v, f. 7. D.F.

1893. *Planorbis bowkeri* M. & P., A.M.N.H., xii, p. 111, pl. iii, f. 19. D.F.

1900. Planorbis rüppelli Krs., Junod, Bull. Soc. Vaudoise, xxxv, p. 279. L.

1910. Planorbis hermanni Bttg., Abh. Senckenb. Ges., xxxii, p. 452, pl. xxviii, f. 18. D.F.

1917. Planorbis pfeifferi Krs., Cawst., Med. J. S. Africa, xii, pp. 183, 184, f. 7. N.F.

1921. Planorbis (Planorbis) hermanni Bttg., Germ., Rec. Indian Mus., xxi, p. 20. D.

1922. Planorbis pfeifferi Krs., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., pp. 40, 42, f. 15. N.F.

1925. Planorbis pfeifferi Krs., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. F.R.

1925. Planorbis pfeifferi Krs., Cawst., Ann. Trop. Med. Parasit., xix, p. 217, f. 5. F.

1925. Planorbis pfeifferi Krs., Cawst., Trans. R. Soc. S. Africa, xiii, p. 40, pl. iv, f. 6. N.F.R.

1925. Planorbis (Planorbula) pfeifferi Krs., Conn., ibid., xii, p. 195, pl. viii, f. 16–19. N.A.R.

1926. Planorbis pfeifferi Krs., Germ. & Nev.-Lem., Ann. Parasit., iv, p. 370. D.F.

1929. Planorbis pfeifferi Krs., Faust, Human Helminthology, pp. 568, 569. N.R.

1929. Planorbis pfeifferi Krs., Cawst., Trans. R. Soc. Trop. Med. Hyg., xxii, p. 336. N.

1930. Planorbis pfeifferi Krs. (=hermanni Bttg.), Conn., Ann. S.A. Mus., xxix, p. 311. N.

1932. Planorbis pfeifferi Krs., Blackie, Mem. London Sch. Trop. Med., v, p. 31, pl. i, f. 3-4. N.F. Eggs.

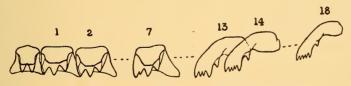
1932. Planorbis pfeifferi Krs., Vogel, Arch. Schiffs-u. Trop.-Hyg., xxxvi, p. 114. N.F.

1933. Planorbis (Coretus) pfeifferi Krs., Germ., Bull. Mus. Paris, p. 139. N.L.

1934. Planorbis pfeifferi Krs., Conn., Ann. Trop. Med. Parasit., xxviii, p. 439. N.

1936. Planorbula pfeifferi pfeifferi Krs., Haas, Abh. Senckenb. Ges., No. 431, p. 24. N.L.

1936. Planorbula pfeifferi hermanni Bttg., Haas, ibid., p. 25.



Text-fig. 42.—Biomphalaria pfeifferi (Krs.), Lorenzo Marques. Teeth from radula;  $\times 500$ .

Shell of fair size, discoid, concave on both sides, especially in centre, silky, moderately glossy, greenish or yellow-brown. Whorls 41, regularly increasing, convex, rounded at periphery, first 2 most deeply sunken, especially above; sculptured all over with strong, fairly regular, curved, oblique transverse striae, divided into granules by microspiral lines, the transverse sculpture becoming stronger and the spiral weaker on the later whorls; suture deep. Aperture  $\frac{3}{4}$  lunar, peristome simple, labrum receding considerably to base, callus, when present, white and thin. An example about same size as type measures

Diam. maj. 12·0, min. 10·3; alt. 4·2; apert. alt. 4·2, lat. 4·6 mm.

Hab. NATAL. Umgeni Valley (type, Krauss); generally distributed along the south coast.

ZULULAND (Burnup).

LORENZO MARQUES. Rikatla (rüppelli); Nyiwan; Makulane; Delagoa Bay (Junod); Itschongove (fide Martens).

S. RHODESIA. Daka R. (Penther); Salisbury, Darwin, Mazoe, Wankie and Chibi Districts (Blackie); near Victoria Falls (Soper); Shangani (Miss Mackie).

TRANSVAAL. Northern Transvaal (bowkeri, Bowker); Pretoria District (Connolly); Mooi R., Potchefstroom; Klerksdorp; Mulders Drift; Scheerpoort (Cawston); Krüger Park (Haas).

OVAMBOLAND. "Ovambonde" (in Calcutta Museum); upper reaches of Omuramba-Omataka River (Shortridge).

BRITISH BECHUANALAND. Maun (Hale Carpenter).

BECHUANALAND. Witkop (Schultze); Postmasburg (Power); Vryburg (Phear).

DAMARALAND. Okaputa Pan (hermanni, Hermann); Okosongomingo (Thomsen); Grootfontein (Lightfoot; Michaelsen).

Type of *pfeifferi* in Stuttgart, *bowkeri* in British, and *hermanni* in Senckenberg Museums. I showed in 1925 that Junod's record of *rüppelli* from Rikatla was incorrect and in 1930 that *hermanni* is entirely synonymous with Krauss's species.

The aperture is very variable in its position with regard to the penultimate whorl, being sometimes in the same plane, usually rising slightly above it and less often somewhat descending, thus of course affecting the shell's altitude, but there is no uniformity about this feature, which may merit little of the importance it has been given in the differentiation of so-called species; the shell varies too, in volution, the last whorl in some specimens being slightly narrower than in others, more typical, of the same size. There also appears to be some anatomical variation, for Watson informs me that animals he has examined from Natal differ slightly from those he described from Lorenzo Marques, notably in the central and lateral teeth of the radula being somewhat longer. But until a larger number have been dissected from different localities I prefer not to attempt to divide the

species, as conchologically the slightly different forms seem to merge into one another.

In rare instances the immature shell from about 6 to 7 mm. in diameter is denticulate, the usual pattern consisting of a small midparietal plait with a minute tubercle below it, and 3 small horizontal plaits, of which the lowest is the most prominent, at nearly equal intervals apart on the interior of the last whorl, some distance within the aperture; with increasing age these processes are apparently absorbed, no trace of them being found on opening mature examples.

The radula of a form with relatively narrow aperture from Lorenzo Marques measures about  $1.65 \times 0.65$  mm., formula (13+8+1+8+13)×125, central bicuspid, about as broad as long, laterals broader and tricuspid, marginals obliquely elongated, their endocones split up into 3 or 4 narrow cusps and ectocones tending to become smaller; they are of the same type as the marginal teeth of Planorbarius, Bulinus, etc., and differ widely from those of *Planorbis* and *Segmentina*.

### Biomphalaria salinarum (Morel.). Ref. List No. 503.

1868. Planorbis salinarum Morel., Voy. Welwitsch, Moll., p. 85, pl. v, f. 4. D.F.

1916. Planorbis salinarum Morel., Germ., Docs. Sci. Miss. Tilho, p. 298. D.

1921. Planorbis salinarum Morel., Germ., Rec. Indian Mus., xxi, p. 22. N.

1926. Planorbis salinarum Morel., Germ. & Nev.-Lem., Ann. Parasitol., iv, p. 372. D.

1930. Planorbis salinarum Morel., Conn., Ann. S.A. Mus., xxix, p. 312. N.

A flatter form than pfeifferi, with very slightly slower increase of whorl; the apical whorls and umbilicus are but little impressed and the angulation around the umbilicus is far more indistinct. There are  $5\frac{1}{2}$  convex whorls, sculptured all over with fairly strong, close, fine growth lines, crossed on upper side of the earlier by spiral lines of varying strength, which are stronger all over the base; suture well marked. Aperture usually horizontal, nearly equal in height and width, little higher than penultimate whorl. The type measures
Diam. maj. 14·7, min. 12·9; alt. 5·9, apert. alt. 5·0, lat. 5·3 mm.

Hab. BRITISH BECHUANALAND. Lake Ngami (subfossil, Passarge).

OVAMBOLAND. Sodanna (subfossil, Passarge).

Described from Dungo Saltings, Angola, and known from Mauretania, Senegal, and the Belgian Congo.

Type in British Museum.

I have not examined Passarge's fossils, which may well be *pfeifferi* Krs., but there is no inherent impossibility of the occurrence of *salinarum* in south-west Africa.

Genus *Planorbis* Müll., 1774 (Verm. Hist., ii, p. 152). Type *Helix planorbis* Lin.

Shell discoidal, usually flatter than in the last genus, the whorls being often angulate or keeled at or below the periphery; always without internal folds. Pseudobranch simple; mantle cavity without the longitudinal folds found in the last genus and Bulinus; central and lateral teeth of radula of the same type as in these, but marginals very different, their cusps being short and separate and arising from the anterior edge of the teeth. Prostate gland usually consisting of a single row of acini; penis without an appendix or gland.

Subgenus Gyraulus Charp., 1837 (Neu. Denkschr. Schweiz. Ges. Naturw., i, p. 21). Type Plan. hispidus Drap. (albus Müll.).

Shell very small and flat, concave above and below, with few rapidly increasing whorls. Radula as in *Planorbis* proper; acini of prostate gland not very numerous; penis with a horny stylet.

Planorbis costulatus (Krs.). (Pl. xvi, f. 1-3.) Ref. List No. 495.

1848. Planorbis costulatus Krs., Südafr. Moll., p. 83, pl. v, f. 8. D.F.

1925. Planorbis (Gyraulus) costulatus Krs., Conn., Trans. R. Soc. S. Africa, xii, p. 199. L.

1925. Planorbis costulatus Krs., Cawst., ibid., xiii, p. 40, pl. iii, f. 3.  $N.F.R.\ast$ 

1927. Planorbis (Gyraulus) costulatus Krs., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 127. N.F.

1936. Gyraulus costulatus costulatus Krs., Haas, Abh. Senckenb. Ges., No. 431, p. 26.  $\,N.$ 

<sup>\*</sup> The shell here figured appears to be natalensis Krs.

Shell small, discoid, thin, asperate, transparent, corneous buff or olivaceous. Apex not much impressed, umbilicus more so. Whorls 4, convex, rather rapidly increasing, subangulate at periphery, which is below the centre line but not on base, sculptured all over with strong, close, regular, curved oblique costulae, without microspiral lineation; suture well defined. Aperture horizontal, nearly circular. A well-grown specimen from Weenen measures

Diam. maj. 5.4, min. 4.5; alt. 1.2; apert. alt. 1.2, lat. 1.2 mm.

Hab. NATAL. Umgeni Valley (type, Krauss; Cawston); Equeefa (Burnup); Weenen (Thomasset); Umbilo; Umbogintwini; Isipingo; South Coast Junction (Cawston).

ZULULAND. Enselini River (Burnup).

TRANSVAAL. Heidelberg (Cawston); Crocodile R. (Connolly); Krüger Park (Haas); Louis Trichart, Zoutpansberg (in South African Museum).

LORENZO MARQUES. Makulane; R. Mitembe, not far from Little Lebombo Hills (Junod).

Also known from Kenya, Uganda, Abyssinia, Sierra Leone, and the Belgian Congo.

Type in Stuttgart Museum.

A well-defined species, easily distinguished by its comparatively small size and strong costulation.

#### Planorbis lamyi Germain.

1905. Planorbis lamyi Germ., Bull. Mus. Paris, p. 255. D.

1908. ,, ,, ,, Moll. Tanganyika, p. 31, f. 4–5. D.F.

1924. Planorbis corniculum Conn., Cawst., Trans. R. Soc. S. Africa, xii, p. 14. L. (Nom. nud.)

Shell small, discoid, openly umbilicate, thin, slightly silky, pale corneous. Spire concave, apex moderately impressed. Whorls  $3\frac{1}{2}$ , rather rapidly increasing, very convex, well rounded at periphery, almost bluntly carinate beneath, first 2 somewhat sunken; sculptured all over with close, regular, well-defined transverse striae, curved and somewhat oblique above, straighter beneath; suture deeply impressed. Aperture nearly circular, slightly descending, very open from beneath, peristome simple, acute, outer lip receding gently until near the periphery and thence very sharply. The shell described, from Ranjesfontein, measures

Diam. maj. 3.75, min. 3.1; alt. 1.5; apert. alt. 1.7, lat. 1.5 mm.

Hab. TRANSVAAL. Ranjesfontein (Connolly); Pretoria (Farquhar; le Roux); Mulders Drift (Cawston).

NATAL. Reunion, Umlaas River (Burnup).

CAPE PROVINCE. Blaauwkrantz, Albany Division (Kincaid).

Type in Paris Museum.

Described from L. Tanganyika, Germain's measurements being diam.  $3-3\frac{1}{2}$ , alt.  $1-1\frac{1}{4}$  mm.

Owing to having been formerly misidentified as the young of pfeifferi Krs. this well-defined and widely diffused species has so far escaped record from South Africa; it is far less high than pfeifferi, of which an average juvenile, 4·2 mm. in major diameter, is 2·3 mm. in altitude; preliminary study caused me to regard it as probably undescribed, and Cawston has unfortunately introduced the MS. name that I had proposed for it into print.

var. albida n.

(Pl. xvi, f. 5-7.)

Lacteous or yellowish white, showing the keel very prominently on the under whorls, with a tendency to grow larger than type and aperture less open from beneath. The largest example seen measures

Diam. maj. 4.7, min. 3.9; alt. 1.6; apert. alt. 1.6, lat. 1.6 mm.

Hab. GRIQUALAND WEST. Riet River (type); Modder River (Swan).

ORANGE FREE STATE. Glen (R. Bigalke).

Type in Kimberley Museum.

The shell of this species resembles in miniature that of a *Biom-phalaria*, but the radula and pallial organs prove it to belong to the present genus.

#### Planorbis natalensis Krs.

(Pl. xvi, f. 8-10.)

Ref. List Nos. 496, 497, 499, and 500.

1848. Planorbis natalensis Krs., Südafr. Moll., p. 83, pl. 5, f. 9. D.F.

1868. Planorbis misellus Morel., Voy. Welwitsch, Moll., p. 85, pl. v, f. 5. D.F.

1877. Planorbis natalis Krs., Sow., Conch. Icon., pl. iv, f. 32. D.F.

1878. ,, gibbonsi Nels., Q.J.C., i, p. 379, pl. iv, f. 3. D.F.

1893. ,, crawfordi M. & P., A.M.N.H., xii, p. 111, pl. iii, f. 20. D.F.

1903. Planorbis leucochilus M. & P., A.M.N.H., xii, p. 607, pl. xxxi, f. 3. D.F.

1914. Planorbis gibbonsi Nels. (=mutandaensis Prest.), D. & G., Rev. Zool. Afr., iv, p. 42. N.

1916. Planorbis gibbonsi Nels., Conn., Ann. S.A. Mus., xii, p. 189.  $N.\,$ 

1917. Planorbis leucocheilus M. & P., Cawst., Med. J. S. Africa, xii, p. 183. N.L.

1923. Planorbis natalensis Krs., Cawst., Trans. R. Soc. S. Africa, xi, p. 124.  $\,L.$ 

1925. *Planorbis gibbonsi* Nels., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. R.

1927. *Planorbis gibbonsi* Nels., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 126. N.F.

1930. Planorbis natalensis Krs., Conn., Ann. S.A. Mus., xxix, p. 312. N.

1930. *Planorbis gibbonsi* Nels., Conn., Ann. S.A. Mus., xxix, p. 312. L.

1935. *Planorbis gibbonsi* Nels., Gardner, Q.J. Geol. Soc., xci, p. 488, pl. xxx, f. 43–48. D.F.

Shell small, flat, smooth, moderately solid, corneous buff or brown. Apex very little depressed, base nearly flat. Whorls 5, slowly increasing, convex, with slight blunt angulation at the periphery, which is on or just below the median line; sculptured all over with very fine, close, curved, oblique transverse striae, which are usually crossed to a varying extent by fine microspiral lines, imparting to the surface a more or less shagreened appearance, but this spiral sculpture is extremely variable in strength and even in presence, especially on the upper surface, sometimes showing quite clearly and sometimes nearly or entirely absent on specimens of the same series; suture well marked. Aperture horizontal, nearly circular, labrum only receding a little. A well-grown example from near the type locality measures

Diam. maj. 5.5, min. 5.0; alt. 1.2; apert. alt. 1.2, lat. 1.5 mm.

Hab. NATAL. Umgeni Valley (natalensis, Krauss; Cawston); Killarney Lake, Pietermaritzburg (leucochilus, Burnup); widely distributed over most of the province.

TRANSVAAL. Aapies R., Pretoria (le Roux); Birchleigh; Potchefstroom; Klerksdorp (Cawston); Ranjesfontein (Connolly).

CAPE PROVINCE. Port Elizabeth (crawfordi, Crawford); Breakfast Vlei (Kincaid); Gleniffer, Kei Road (Ranger); Black River, Maitland, near Cape Town (Connolly); Cape St. Francis (Rogers).

BRITISH BECHUANALAND. Witkop (subfossil, Schultze).

GRIQUALAND WEST. Newlands (Miss Paton); Papkuil (Swan). ORANGE FREE STATE. Parys; Mazelspoort, near Bloemfontein; Schultze's Draai (Cawston); Morgendal (Connolly).

BRITISH BECHUANALAND. Chukudu District; Okwa R. (subfossil, Rogers); Ghansi District (Hale Carpenter).

KAOKOVELD. Kamanyab (subfossil); near Otjitundua (Barnard). DAMARALAND. Gobabis (subfossil, Hermann).

Type of natalensis in Stuttgart, misellus, crawfordi, and leucochilus in British Museum; gibbonsi ubi?; mutandaensis (ined.) in British Museum.

Pl. gibbonsi was described from Zanzibar and misellus from L. Quilunda, Angola, and the range seems to include many localities in Kenya and Uganda, Lakes Albert and Edward, Northern Rhodesia, etc., while it has recently been collected subfossil in the Kharga Oasis, in Egypt, and recent at Wau, A.-E. Sudan. Examples from L. Mutanda were distributed by Preston under the MS. name cited by Dautzenberg and Germain, but as it has never been published there was no occasion for them to introduce it into synonymy; the undescribed type is absolutely conspecific with the form now universally attributed to that described by Nelson, but so badly illustrated in the paper where it appeared.

After very careful consideration of the types of natalensis, misellus, crawfordi, and leucochilus, and Zanzibarian examples of gibbonsi from near the type locality, with large series from other parts of South and Central Africa, it appears impossible to discover any constant grounds for even varietal distinction between them. A character of frequent occurrence in this species at certain stages of growth, especially when very young, is a very noticeable thickening of the peristome, which leaves a strong varix when normal growth is resumed; it is not at all constant, there being occasionally 2 or even more varices and far more often none at all on specimens of the same series; leucochilus was based on two extremely small shells which had just formed this thickening and therefore were an appearance of maturity, but agree in that respect with the immature stage of many individuals from other localities which have subsequently developed into typical examples of natalensis; but another perplexing feature about this species is that, under certain conditions which I cannot explain, local races fail, for the most part, ever to attain normal dimensions, or remain undeveloped for very many months before they do so. I collected at one spot in the Black River, Maitland, on many occasions over a period of two years, and for nearly the entire period found none but small specimens, after which, on two visits, they came to hand in quantity of full normal size, an important point in so far as it may affect the status of the species which follows.

Planorbis anderssoni Ancey.
(Pl. xvi, f. 4.)
Ref. List No. 494.

1890. Planorbis anderssoni Ancey, Bull. Soc. Mal. Fr., vii, p. 161. D.

1914. *Planorbis anderssoni* Ancey, Thiele, D. Südpol. Exp., xvi, p. 100. D.F.

1925. *Planorbis* (*Spiralina*) anderssoni Ancey, Conn., Trans. R. Soc. S. Africa, xii, p. 200. L.

1930. Planorbis anderssoni Conn., Ann. S.A. Mus., xxix, p. 313. N.

As the type set appears to be lost, it is necessary to accept as typical specimens from Stamford Hill, Durban, identified by Ancey himself as his own species. They seem hardly distinguishable from the immature stage of natalensis, but may possibly be distinct by reason of their small size, if a permanent feature, and the fact that they do not appear to form varices. The colour is reddish or yellow brown and they are sculptured all over with strong, very close, slightly curved and oblique striae cut, in fresh clean specimens, by close, regular, microspiral lines. My largest Stamford Hill shell with nearly 4 convex whorls measures diam. maj. 3-3, min. 3-0; alt. ca. 1 mm.

Fairly long series from the under-mentioned localities other than that of the type may possibly be referable to Ancey's little species.

OVAMBOLAND. Ovambonde (type, Andersson & Chapman).

NATAL. Stamford Hill and other localities round Durban (common); Mooi River; Scottburgh; Umhlatuzana (Cawston).

CAPE PENINSULA. Lakeside (Connolly); Lange Vlei, Retreat (D. Süd-pol. Expn.).

CAPE PROVINCE. Burnt Kraal, Grahamstown (Farquhar).

TRANSVAAL. Birchleigh, Pretoria (Cawston).

LORENZO MARQUES. Hangwane; Nwambukoto, Rikatla (Junod).

Genus Segmentina Fleming, 1818

(Enc. Brit., Suppl. to 4th, 5th, and 6th editions, iii, p. 309).

Type Nautilus lacustris Lightf. (Plan. nitidus Müll.).

Shell small, lenticular, glossy; whorls deeply embracing and angulate at the periphery; spire slightly sunk, umbilicus deep. Pallial organs as in the last genus; radula also similar, except that the lateral teeth have smaller cusps and are more like the marginals. Prostate gland consisting of an irregular row of acini; penis without a stylet, but having a posterior appendix, which is usually split in two.

#### Subgenus Segmentina s.s.

Interior of shell bearing radial folds at intervals, which usually show white through the transparent shell.

# Segmentina planodiscus (M. & P.).

Ref. List No. 505.

1897. Planorbis (Segmentina) planodiscus M. & P., A.M.N.H., xix, p. 638, pl. xvii, f. 10. D.F.

1923. Segmentina planodiscus M. & P., Germ., Rec. Indian Mus., xxi, p. 167. D.N.

1925. Segmentina planodiscus M. & P., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. R.

1925. Segmentina planodiscus M. & P., Cawst., Trans. R. Soc. S. Africa, xiii, p. 40, pl. iii, f. 2. N.F.R.

1930. Segmentina planodiscus M. & P., Conn., Ann. S.A. Mus., xxix, p. 314. N.

Shell small, discoid, umbilicate, smooth, glossy, bright amber. First 3 whorls of spire slightly impressed. Whorls  $5\frac{1}{2}$ , last 3 moderately convex and rapidly increasing, with blunt peripheral angulation except nearing the aperture of full-grown shells, sculptured above with close, somewhat irregular, curved, slightly oblique striae, which become straight and radial on the flattened base, which also shows fine, close, faint microspiral lineation; suture simple, of moderate depth. Aperture bluntly barbiform, columellar margin not approaching umbilicus, which is moderately wide, extending to summit and just exposing all the whorls. The last whorl contains at intervals 5 or 6 series of radial folds, of which each normally consists of (i) a small fold above the periphery, usually short, but sometimes having a narrow extension nearly to the suture; (ii) a long, nearly straight basal fold, which is more conspicuous but low except near its outer end, and (iii) a parietal fold curving over the periphery of the penultimate whorl but mainly below it. Unlike the other two, the parietal fold is slightly oblique, the lower end being farther forward than the upper.

Diam. maj. 5.8, min. 5.1; alt. 1.6; apert. alt. 1.0, lat. 2.1 mm.

Hab. NATAL. Umgeni Valley, near Durban (type, Burnup); Durban; Illovo Lagoon; Merebank; Isipingo; Umbilo; Sydenham District; Umbogintwini; Mayville (Cawston).

OVAMBOLAND. "Ovambonde" (in Indian Museum and coll. Connolly).

CAPE PROVINCE. Port St. John's (Power).

Also known from Albert Nyanza.

Type in British Museum.

Watson tells me that this form appears to differ from the European species in having a single, instead of a double, penial appendix.

## Segmentina kanisaënsis Prest.

1914. Segmentina kanisaënsis Prest., Linn. Soc. J., xxxii, pp. 243, 265, pl. xviii, f. 17–19. D.F.

1923. Segmentina nov. sp., Cawst., Trans. R. Soc. S. Africa, xi, p. 122. L.

1924. Segmentina kanisaënsis Prest., Cawst., Trans. R. Soc. S. Africa, xii, p. 14. N.L.

Shell very small, nearly flat, umbilicate, smooth, thin, shining, transparent, yellowish corneous. Spires slightly concave. Whorls 41, convex above, very rapidly increasing, the last comprising about two-thirds of the shell, a little rounded and gently sloping above, rather sharply keeled on the lower part of the periphery, almost flat beneath, sculptured on both sides with close, strong transverse striae, undulate in the curves of the outer lip, and extremely faint traces of microscopic spiral striae above, which become much more visible beneath; suture strongly impressed. Last whorl containing 3 white, slightly incurved septa. Aperture acutely barbiform in profile, somewhat triangulate from beneath, outer lip slightly outcurved and then receding sharply above, straight beneath; umbilicus wide, openly exposing all the whorls.

Diam. maj. 3.8, min. 3.5; alt. 1.0; apert. alt. 1.0, lat. 1.5 mm.

Hab. NATAL. Merebank (Cawston).

Described from Kanisa, A.-E. Sudan (Mrs. Longstaff), and recently recorded from Albert Nyanza.

Type in British Museum, specimen described from Merebank in my collection.

Differs from planodiscus in its more pronounced sculpture, which causes the surface to appear slightly less glossy; in being more loosely coiled, the penultimate whorl thus appearing broader, and in its more open umbilicus, which discloses all the whorls, whereas in planodiscus it is deep, but narrow, hardly disclosing the penultimate whorl. The septa are more curved and fewer in number, averaging 3 in the last whorl, while in planodiscus they are nearly straight and more numerous, 5 or more being often visible on the last whorl.

Subgenus Hippeutis Charp., 1837 (Agassiz MS. in Charp., Neu. Denkschr. Schweiz. Ges., i, No. 2, p. 22).

Type  $Helix\ complanatus\ L.\ (=fontanus\ Lightf.).$ 

Comprises those Planorbid shells which would be placed in Seqmentina s.s. but for absence of the septa from which that genus derives its name; two species have as yet been described from South Africa. Any doubts that this group should be regarded as a subgenus of Segmentina rather than of Planorbis have been dispelled by Odhner's account of the anatomy of the type species (Sjön Tåkerns Fauna och Flora, pt. 8, 1929, p. 32).

> Segmentina (Hippeutis) emicans (M. & P.). Ref. List No. 504.

1892. Planorbis (Segmentina) emicans M. & P., A.M.N.H., x, p. 241, pl. iii, f. 13. D.F.

Shell very small, discoid, umbilicate, smooth, shining, deep corneous orange. Spire much impressed. Whorls too eroded to count and aperture too broken to describe, but there are no traces of septa and the sculpture is confined to moderately strong striae in the lines of growth and dense microscopic punctation, probably of no value. The broken shell measures  $2.7 \times 2.3$  mm, in diameter and 1.0 mm, in altitude; the basal edge of the peristome extends into the umbilicus.

Hab. CAPE PROVINCE. Port Elizabeth (Farquhar).

Type in British Museum.

This species has not recurred since its original discovery and the type has been the only specimen available for examination.

Segmentina (Hippeutis) junodi Conn.

(Pl. xv, f. 13-15.)

1922. Hippeutis junodi Conn., A.M.N.H., x, p. 121. D.

1925. Segmentina (Hippeutis) junodi, Conn., Trans. R. Soc. S. Africa, xii, p. 200, pl. iv, f. 30. N.F.

Shell small, discoid, umbilicate, thin, shining, reddish corneous. Spire much impressed. Whorls 4, rapidly increasing, each rising considerably above its predecessor, the last, which comprises practically the entire shell, rounded and convex above, sloping somewhat abruptly down to the roundly keeled base, slightly concave beneath, microscopically sculptured on both sides with close transverse striae of irregular prominence, undulating with the curves of the outer lip; suture impressed. Aperture barbiform, pointing slightly downward in frontal view, squarely quadrate from beneath; peristome simple, curve of labrum at first receding infinitesimally, then advancing slightly and receding rapidly above, almost straight beneath and not extending into the umbilicus, which is not wide, but deep, extending to the apex and hardly disclosing all the whorls.

Diam. maj. 5·3, min. 4·7; alt. 1·5; apert. alt. 1·5, lat. 2·4 mm.

Hab. LORENZO MARQUES. Nwambukoto, Rikatla (type); Hangwane (Junod).

Type in British Museum.

The extreme declivity of the labrum from suture to periphery distinguishes this species from other African members of the genus.

Cawston has collected some examples of another species at Beira, but they are too immature for exact determination.

Subfamily Bulininae.

Shell sinistral, obovate, inverse conoid or narrow turriform.

Genus Bulinus Müll., 1781 (Der Naturforscher, xv, pp. 5 and 6). Type B. senegalensis Müll.

(= Bulinus Adanson, 1757 (pre-Linnean); Isidora Ehrn., 1831, and Diastropha Gray, 1840).

Shell sinistral, ovate or elongate, corneous brown; pseudobranch elaborately folded; mantle cavity with a pair of longitudinal folds,

one on the roof above the kidney, the other on the rectum; kidney reflexed anteriorly; radula with bicuspid central, tricuspid laterals, and multicuspid marginals, with the reflected part of these teeth very long, as in Lymnaea. Prostate gland compact and rounded; penis without an appendix or gland.

The long controversy as to the claims of Bullinus, Bulinus, and Isidora to priority for the present genus appears in general opinion to be definitely decided in favour of Müller's name. Bullinus, to which French authors still adhere, is absolutely inadmissible, while Bulinus, which remained doubtful on account of uncertainty as to the generic identity of Adanson's "Le Bulin," is now proved to be a member of what has been for many years known as Isidora, whence it is greatly to be hoped that the vexed question may be accepted as finally settled.

#### Subgenus Bulinus Müll. s.s.

Shell usually rather dull, columella nearly straight or sometimes sinuous, but not truncate basally; mantle cavity with only the single pair of longitudinal folds.

#### Section Bulinus Müll. s.s.

Shell more or less ovate, spire short or of moderate length, last whorl and aperture relatively large.

(i) Shells of fair size, exceeding 9 mm. in length.

Bulinus natalensis (Küst.).

(Pl. xvi, f. 20.)

Ref. List No. 521.

1841-3. Physa natalensis Krs., Küst., Conch. Cab. (Limn.), p. 8, pl. i, f. 12–14. D.F.

1883. Physa natalica Bgt., Ann. Sci. nat. Paris, xv, pp. 98, 126. N.

1903. Physa zuluensis M. & P., A.M.N.H., xii, p. 606, pl. xxxii, f. 4. D.F.

1925. Isidora natalensis Krs., Conn., Trans. R. Soc. S. Africa, xii, p. 190. L.

1927. Physopsis natalensis Küst., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 143.

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1930. Bulinus natalensis Krs., Conn., Ann. Natal Mus., xxix, p. 315. N.

1932. Bulinus natalensis Krs., Blackie, Mem. London Sch. Trop. Med., v, p. 34, pl. i, f. 7. N.F.

1936. Physopsis natalensis Krs., Haas, Abh. Senckenb. Ges., No. 431, p. 33. N.L.

Shell of fair size, nearly oval, narrowly rimate, thin, smooth, transparent, moderately glossy, pale corneous brown. Spire usually but little produced. Whorls 4, convex, the last comprising nearly the entire shell, sculptured with close, weak, regular, vertical striolae and, in very fresh specimens, traces of extremely faint, regular, microspiral lineation; suture well defined. Aperture very large, labrum straight and erect in profile, columella white, long, narrow, erect, with a slight, though well-marked twist half-way up but no genuine basal truncation, margin very narrowly reflexed, nearly concealing the narrow rima.

Long. 12.6, lat. 9.0; apert. alt. 9.1, lat. 4.5; last whorl 11.3 mm.

Hab. NATAL. Umgeni Valley (type, Krauss); frequent near the coast about the Durban District.

EAST ZULULAND (zuluensis, Burnup); Lake Sibayi (Toppin).

TRANSVAAL. Great Letaba R. (Haas).

LORENZO MARQUES. Lebombo Marsh, Rikatla; Monguane; Makulane (Junod); Beira (Cawston); L. Zandemala (Lawrence).

RHODESIA. Near Victoria Falls (Soper); Nyamgai Marsh (Blackie).

BECHUANALAND. Witkop (subfossil, Schultze).

OVAMBOLAND. Upper reaches of Omuramba-Omataka R. (Shortridge).

Also recorded by Haas from the Belgian Congo.

Type of natalensis in Stuttgart, zuluensis in British Museum.

Mainly recognisable by the thin columella with distinct twist on its inner margin; Soper's and Shortridge's sets consist of small, rather degenerate forms such as often occur in localities subject to periodical desiccation, while Blackie's are quite remarkably attenuated and would merit a distinct name if a sufficient quantity proved to be constant in that respect. The series from Beira and L. Zandemala are extremely dwarfed, but referable to natalensis rather than to diaphanus.

Bulinus natalensis is placed by Pilsbry and Bequaert in Physopsis on account of "oblique truncation of the columella"; the columella, however, is not truncate at base, as in Physopsis, but the inner margin is distinctly twisted about half-way up, the chief feature by which natalensis may be distinguished from B. tropicus, in which it is straight. While it is difficult to separate intermediate forms of these

two species in localities where they live together and perhaps interbreed, I have never found trouble in differentiating between natalensis and Physopsis africana, though the fact that they often live together and have been distributed together by certain collectors under the same specific name may have caused misapprehension as to their relationship.

#### Bulinus angolensis (Morel.).

Ref. List No. 516.

1866. Physa angolensis Morel., J. de C., xiv, p. 162. D.

1873. algoensis Morel., Sow., Conch. Icon., pl. vii, f. 53. D.F. (Err. typ.)

1930. Bulinus angolensis Morel., Conn., Ann. S.A. Mus., xxix, p. 314. N.

1931. Bulinus angolensis Morel., Beq. & Clench, Occ. Pap. Boston Soc. N.H., v, p. 360, pl. xviii, f. 10. N.F.

Morelet remarks that his species resembles natalensis in form, size, and texture, but has a much shorter spire, often quite flat at the summit, a broader aperture and different coloration, being chestnut, or more rarely olivaceous.

The two species are extremely near akin, but the microspiral sculpture of angolensis is slightly less faint than in natalensis and the columella is usually straight, lacking the slight twist that features the more eastern species; it would, however, take very little to unite them. The type is unusually large; a paratype of average size in my collection measures

Long. 10.8, lat. 8.0; apert. alt. 9.4, lat. 4.5; last whorl 10.5 mm.

Hab. DAMARALAND (algoensis, Geale, in British Museum).

OVAMBOLAND. Tamansu; Ongandjera (Barnard). Type in British Museum.

Described from Angola and recorded from the Belgian Congo; the Tamansu shells are of a beautiful olivaceous hue and quite typical.

# Bulinus tropicus (Krs.).

(Pl. xv, f. 38-39; Pl. xvi, f. 21-22, and text-fig. 43.) Ref. List Nos. 517, 518, 523, 524.

1848. Physa tropica Krs., Südafr. Moll., p. 84, pl. v, f. 12. D.F.

1856. ,, cyrtonota Bgt., Rev. et Mag. Zool., viii, p. 238, pl. xv, f. 1-2. D.F.

1880. Physa lirata Crvn., P.Z.S., p. 617, pl. lvii, f. 10. D.F.

craveni (=lirata Crvn., 1880, non Tristram, 1863), Ancey, Le Naturaliste, viii, p. 358.

1903. Isidora compta M. & P., A.M.N.H., xii, p. 606, pl. xxxii, f. 14. D.F.

1914. Isidora contorta Mich., Thiele, D. Südpol. Exp., xvi, p. 100.  $N.L.\,$ 

1916. Isidora contorta Mich., Conn., Ann. S.A. Mus., xiii, p. 190. N.

1917. ,, tropica Krs., Cawst., Med. J. S. Africa, xii, pp. 183, 184, f. 1-2 (pessime). N.F.

1919. Isidora schakoi Jick., Cawst., S. Afr. J. Sci., p. 1 (abstract). L. 1923. ,, schackoi Jick., Cawst., Trans. R. Soc. S. Africa, xi, pp. 119, 125. L.

1924. Isidora schackoi Jick., Cawst., Parasitology, xvi, p. 67. L.

1924. " sericina Jick., Cawst., ibid., p. 67. L.

1925. ,, *tropica* Krs., Cawst., J. Trop. Med. Hyg., xxviii, pp. 151, 365. *R.F.* 

1925. Isidora craveni Ancey, Cawst., ibid., p. 366. F.

1925. ,, ,, ,, Ann. Trop. Med. Parasit., xix, p. 217, f. 3. F.

1925. Isidora tropica Krs., Cawst., ibid., p. 217, f. 4. F.

1925. ,, ,, ,, ,, Trans. R. Soc. S. Africa, xiii, p. 41, pl. iv, f. 4. N.F.R.

1926. Bullinus (Isidora) tropicus Krs., Germ. et Nev.-Lem., Ann. Parasit., iv, p. 365. D.

1927. Isidora tropica Krs., Cawst., Ann. Trop. Med. Parasit., xxi, p. 36, pl. v, f. 5. F.

1927. Isidora tropica Krs., Cawst., J. Med. Ass. S. Africa, i, p. 309. N.F.

1929. Bulinus (Isidora) tropicus Krs., Faust, Human Helminthology, p. 568. N.

1929. *Bulinus tropicus* Krs., le Roux, 15th Rept. Vet. Surv. Union S. Africa, pp. 408, 436, f. 14-17. *N.F.* 

1929. Bulinus schackoi Jick., le Roux, ibid., p. 437, f. 32–33. F. 1930. ,, tropicus Krs., Conn., Ann. S.A. Mus., xxix, p. 315. N.

1931. Bulinus cyrtonotus Bgt., Beq. & Clench, Occ. Pap. Boston Soc. N.H., v, p. 362, pl. xviii, f. 1-5. D.F.

1931. Bulinus comptus M. & P., Beq. & Clench, ibid., p. 359, pl. xviii, f. 6. N.F.

1931. Bulinus tropicus Krs., Beq. & Clench, ibid., p. 364, pl. xviii, f. 12. N.F.

1932. Bulinus tropicus Krs., Blackie, Mem. London Sch. Trop. Med., v, p. 33, pl. i, f. 6. N.F.

1936. Bulinus (Bulinus) hemprichii tropicus Krs. (=compta M. & P.), Haas, Abh. Senckenb. Ges., No. 431, p. 27. N. Shell of average size, more or less globose ovate, perforate, thin, silky, corneous yellow-brown. Spire more or less produced, apex mamillate. Whorls 4-5, convex, rapidly increasing, 1st smooth, remainder sculptured with close, fairly regular, nearly straight and vertical striae, varying greatly in strength on individual shells, and showing trace of faint, regular, microspiral lineation on the early whorls of very fresh examples; suture well defined. Aperture ovate, labrum straight and erect in profile, columella white, glossy, erect, usually straight, margin more or less broadly reflexed over the narrow rima; there is usually a continuous white callus in adult shells. The paratype figured measures

Alt. 10·7, lat. 8·2; apert. alt. 7·3, lat. 4·6; last whorl 10·2 mm.; it is selected

Alt. 10.7, lat. 8.2; apert. alt. 7.3, lat. 4.6; last whorl 10.2 mm.; it is selected as agreeing with the type, but is squatter and more globose than the generality of specimens, the spire being usually considerably longer, as is the case in another

of my paratypes.

Hab. TRANSVAAL. R. Lepenula (type, Wahlberg); Mooi River (lirata, Craven; Cawston); Pretoria; Aapies River, near Onderstepoort; Bloemhof (le Roux); Boksburg (compta, McBean).

BASUTOLAND. Morija (A. Porter).

S. RHODESIA. Makabusi River (Blackie); Enkeldoorn District (Miss Sharpe-Young).

ORANGE FREE STATE. Kopjes; Morgendal; Lindley (Connolly); Parys; Clocalan; Schuttes Draai (Cawston); Arlington; Ficksburg (le Roux).

NATAL. Durban; Illovo; Umbilo; Umgeni; Umhlanga; Umhlangana; Umhloti; Umbogintwini; Mayville; Isipingo; Sydenham District (Cawston).

CAPE PROVINCE. Olifants River (cyrtonota, Verreaux); Port Elizabeth (Crawford); Stellenbosch (Péringuey); Montagu; Maitland, near Cape Town (Connolly), and many other localities.

CAPE PENINSULA. Frequent.

GRIQUALAND WEST. Kimberley District (Power); Newlands (Miss Wilman); Papkuil (white var., Gore).

DAMARALAND. Okosongoho; Okaputa Pan (subfossil, Hermann); Ondahaka (Edlinger).

KAOKOVELD. Kamanyab (subfossil, Barnard).

BECHUANALAND. Kuruman R., Gordonia (Rogers).

Type of tropicus in Stuttgart, craveni and compta in British, cyrtonota in Geneva Museum.

Radula (text-fig. 43) formula  $(22+8+1+8+22) \times 90+n$ ; laterals change form at No. 9, outer marginals like No. 20, of slightly smaller size.

While very variable within certain limits, the shell is usually distinguishable by its somewhat obese contour and broadly reflexed columellar margin. It is the common form throughout the Union,

and occurs occasionally, as at Umgeni Mouth, in company with natalensis, with which it appears to interbreed, when every degree of intermediate is developed, so that it is practically impossible to draw the line between them, though the typical forms are easily recognisable. It is probable, too, that under unfavourable conditions the species becomes dwarfed, bearing in this case the name of corneus Morelet.



Text-fig. 43.— $Bulinus\ tropicus\ (Krs.)$ , paratype, R. Lepenula. Teeth from radula;  $\times 600$  approximately.

I have the high authority of Paul Pallary for reducing comptus to synonymy. When preparing my Reference List the only feature by which it appeared possible to differentiate the type from tropicus was that the outer lip is distinctly flattened and almost incurved for a short way below the suture, but this was not considered of sufficient importance by its authors to be included in their original diagnosis, and in Pallary's view is merely an adventitious feature; in other respects the shell is simply a well-grown example of Krauss's species.

It is incomprehensible to me why Bequaert and Clench resuscitated cyrtonotus, which had remained conchologically defunct since slain by Jickeli sixty years ago. In course of doing so they transferred the site of the Olifants River, although Bourguignat said it was in the Cape Province, to the Transvaal and stated that the shells they figured from Aapies River came from the drainage of the river from which cyrtonotus was originally described. But E. Verreaux never visited the Transvaal, the travels of the three Verreaux brothers being confined to the Cape Colony and Natal; in any case the Aapies River shells, of which I have examined a pair, agree in all respects, as does Bourguignat's figure of cyrtonotus, with some of my paratypes of tropicus.

P. lirata Crvn. is also well represented among these paratypes; it is, as mentioned in Krauss's description, merely the young state of tropicus, in which the epidermis is usually somewhat highly lirate, though this feature rarely persists except under extremely favourable conditions, becoming obliterated as the shell increases in size.

It appears to have been the object of writers on South African

Mollusca thirty-five years ago to make its local fauna as all-embracing as possible, to which end all species not clearly defined in the British Museum were either described as new or referred for identification to experts overseas, whose decisions were readily accepted, even when given by persons without knowledge of South African conditions. This led to the introduction of schackoi, sericina, and to some extent contorta into the local list, but there is no object in retaining them, since the local forms attributed to the northern species answer just as well to the variable tropicus. It is becoming generally accepted that all the Egyptian so-called species of Bulinus, except forskalii, are in reality but forms of truncatus Aud., and some of these differ far more widely from each other than those now included in my synonymy of tropicus. The exact relationship of truncatus (=contortus) and tropicus, linked probably by a host of Central African forms, must be decided by future students of anatomy; meanwhile, on geographical no less than conchological grounds, intermingling their names and habitat can only cause unnecessary complications.

## var. verreauxii Bgt. Ref. List No. 525.

1856. Physa verreauxii Bgt., Rev. et Mag. Zool., viii, p. 237, pl. xv, f. 3-4. D.F.

1924. Isidora verreauxi Bgt., Cawst., Parasitology, xvi, p. 67. L. 1929. "A freshwater shell from Goudini," le Roux, 15th Rept. Vet. Surv. Union S. Africa, p. 436, f. 18-21. N.F.

1931. Bulinus verreauxii Bgt., Beq. & Clench, Occ. Pap. Boston Soc. N.H., v, p. 363, pl. xviii, f. 9. D.F.

1936. Bulinus (Diastropha) raymondianus verreauxii Bgt., Haas, Abh. Senckenb. Ges., No. 431, p. 32. N.

I can only regard this as a slightly abnormal form, scarcely a variety, of tropicus in which, by reason of unusual prolongation of the spire through obliquity of the sutures, it assumes in dorsal view a snout-like aspect; like cyrtonotus, it was collected by Verreaux, probably in company with the latter, in the Olifant River, and although I have seen individuals from many localities which can be matched with Bourguignat's figure, they have with a single exception formed part of a series in which tropicus predominates, linked by intermediates to the typical form. Fig. 21 depicts a fairly typical example, and fig. 22 an extreme form in which the prolonged snout tends to scalarity, both of which occurred in a normal assemblage of tropicus from Kimberley.

Bourguignat's type measures 14 × 9, aperture 9 × 4 mm.; it was differentiated from tropicus by longer spire, less obese, acute summit, and less swollen whorls. The largest specimen examined, with 5 whorls, is  $16.2 \times 9.3$ , apert.  $9.3 \times 4.9$ , last

whorl 12.6 mm.

Hab. CAPE PROVINCE. Olifants River (type); Knysna (Verreaux); Stellenbosch (Grobbelaar); Goedemoed Farm, Goudini, Worcester (le Roux); Elbert's Kraal, Albertinia (J. W. Horn).

GRIQUALAND WEST. Kimberley (Power).

ORANGE FREE STATE. Ficksburg; Schuttes Draai (Cawston); Glen, near Bloemfontein (A. Porter).

TRANSVAAL. Olifants R. and Great Letaba R. (Haas).

BASUTOLAND. Morija (Junod).

CAPE PENINSULA. Retreat Vlei (Connolly); Kalk Bay (fide Haas).

Type ubi?

# Bulinus parietalis (Mouss.). Ref. List No. 522.

1887. Physa parietalis Mouss., J. de C., xxxv, p. 298, pl. xii, f. 8. D.F.

1922. Isidora parietalis Mouss., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., pp. 44, 45, f. 16. D.F.R.

1930. Bulinus parietalis Mouss., Conn., Ann. S.A. Mus., xxix, p. 315. N.

1936. Bulinus (Diastropha) brocchii parietalis Mouss., Haas, Abh. Senckenb. Ges., No. 431, p. 31. N.

Nearly allied to *tropicus*, but usually with more shouldered whorls and more impressed suture, while the transverse sculpture on the last 3 whorls consists of strong, fairly regular, subdistant costulation; the callus from which it derives its name, usually though not invariably present, is of no value for specific separation, and is no stronger than in the type set of *tropicus*. The shell is reddish or greyish brown, the specimen described, from Klein Karas, comprises 4 whorls and measures

Long. 9·3, lat. 7·6; apert. alt. 6·7, lat. 4·4; last whorl 8·7 mm., while the type was said to be  $10·0 \times 7·8$  mm.

Hab. OVAMBOLAND. Ondongua (type, Schinz); Andoni (Barnard).

DAMARALAND. Otjituezu, 66 km. N.E. of Frauenstein and 50 km. E.N.E. of Windhoek (Michaelsen).

GREAT NAMAQUALAND. Hoolog, Klein Karas Mts.; Keetmanshoop (Miss Hill).

BECHUANALAND. Lake Ngami; Garu; fossil south of Hardekol Drift, Botletle R. (Passarge).

BRITISH BECHUANALAND. Witkop (subfossil, Schultze).

Morelet's record of Port Elizabeth cannot refer to this particular species.

Type in Zurich Museum.

This species varies considerably in strength of sculpture, but is

very constant in form; Mousson compared it with natalensis, to which it bears small likeness; had he done so with tropicus it may be doubted if he would have differentiated it.

### (ii) Shell normally small, not exceeding 8 mm. in length.

Somewhat widely distributed about the country are to be found colonies of small, apparently debased races of *Bulinus*, displaying considerable variation in the same series, and probably derived for the most part from *B. tropicus*. Two forms have received names, which, in default of positive proof of their true relationship, it may be convenient to retain for these small races that do not appear to attain the dimensions of the larger species, with the proviso that if they are found to do so, the names will fall into synonymy. The older of these is

## Bulinus diaphanus (Krs.). (Pl. xvi, f. 23, and text-fig. 44.) Ref. List No. 519.

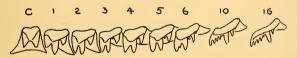
1848. Physa diaphana Krs., Südafr. Moll., p. 84, pl. v, f. 11. D.F.

1922. Isidora diaphana Krs., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 47, f. 18. D.F.R.

1923. Isidora diaphana Krs., Cawst., Trans. R. Soc. S. Africa, xi, pp. 123, 124. L.

1929. Isidora diaphana Krs., Adens., Ann. Naturh. Mus. Wien, xliii, p. 397. N.

1930. Bulinus diaphanus Krs., Conn., Ann. S.A. Mus., xxix, p. 316. N.



Text-fig. 44.—Bulinus diaphanus (Krs.), paratype, Port Natal. Teeth from radula;  $\times$  600 approximately.

Shell small, more or less acuminate ovate, rimate, thin, smooth, transparent, corneous yellow-brown or olivaceous. Spire slightly produced, apex acute. Whorls 4, convex, rapidly increasing, apical smooth, remainder sculptured with very close, fine, regular, vertical striolae; suture simple, well defined. Aperture acuminate ovate, columella thin, white, straight, erect, margin very narrowly reflexed, half concealing the narrow rima.

Long. 7.9, lat. 5.0; apert. alt. 5.6, lat. 2.9; last whorl 7.1 mm.

The paratype described approaches closely Krauss's type, but the spire is rather more exserted in the generality of specimens.

Hab. NATAL. Umgeni Valley (type, Wahlberg; Cawston).

DAMARALAND. Neitsas Farm, near Grootfontein (Fock); between Nuragas and Fockshof (Lebzelter).

CAPE PROVINCE. Robertson (Miss Wilman).

Radula formula  $(25+5+1+5+25) \times 90 + n$ . Laterals change form at No. 6, outer marginals similar to No. 16, of slightly diminished size.

## Bulinus corneus (Morel.).

(Pl. xv, f. 31.)

Ref. List No. 526 (as zanzibarica Cless.).

1889. Physa cornea Morel., J. de C., xxxvii, p. 16, pl. i, f. 8. D.F. 1897. Isidora zanzibarica Cless. (=cornea Morel.), Mts., D.-O.-Afr., p. 140. N.

1929. Bulinus "immature," le Roux, 15th Rept. Vet. Surv. Union S. Africa, p. 437, f. 22-26. N.F.

1931. Bulinus corneus Morel., Beq. & Clench, Occ. Pap. Boston Soc. N.H., v, p. 358, pl. xviii, f. 7. N.F.

Simply a small reproduction of *tropicus*; Morelet differentiated it from other species in that occasional lines of growth are darker brown than the rest of the shell, a purely adventitious feature. One of my paratypes, agreeing with the type, measures

Long. 8.0, lat. 5.5; apert. alt. 5.0, lat. 3.3; last whorl 7.5 mm.

Hab. CAPE PROVINCE. Port Elizabeth (type, Crawford); Grahamstown (Farquhar); Humansdorp (le Roux).

NATAL. Mooi River (Cawston).

ORANGE FREE STATE. Swinburne (Cawston); Bloemfontein (le Roux).

BASUTOLAND. Mafeteng (Cawston).

CAPE PENINSULA. Wynberg (Connolly).

DAMARALAND. Osondeku, near Okahandja (Hoesch).

Paratypes in British Museum.

Martens reduced this species to the synonymy of zanzibarica on the ground that he received from Morelet in 1880 shells labelled "Zanzibar" identical with some published by Clessin in 1886 under that name, but this argument does not appear to hold good. Clessin's species measures  $13\times10$  mm., whereas Morelet founded cornea in 1889 on shells received from Ponsonby, collected by Crawford in Port Elizabeth, none of which much exceed  $8\times5\frac{1}{2}$  mm. nor appear referable to the larger form, so that Morelet's name can be applied to the

numerous small, short-spired races, probably a degenerate form of tropicus, that are found in many pools scattered over the subcontinent. Bequaert and Clench attributed a race of this species from Bloemfontein to tropicus, into which it might well develop under favourable conditions, but in its stunted shape is entirely typical of corneus, which proves the very thin line of demarcation that can be drawn between them. A tiny race of this species from Wynberg (probably Cape Flats) (pl. xv, f. 31, where it is magnified to twice its size) is fully mature, almost senile, as evinced by the massive white callus; the costate sculpture is extraordinarily strong, about 35 ribs on face of body whorl; with 3 whorls the shell measures

Alt. 4.0, lat. 2.6; apert. alt. 2.5, lat. 1.5; last whorl 3.8 mm.

Section Pyrgophysa Crosse, 1879
(J. de C., xxvii, p. 208).

Type P. mariei Crosse
(=Pyrgobullinus Plry., 1923).

Narrow elongate shells with many whorls and short aperture. It is doubtful whether this section contains more than one very variable species. Although the elongate typical form is very distinct from typical Bulinus, every grade of intermediate occurs, until it is difficult to decide whether the Angolan form described by Morelet as Physa crystallina should be placed in Bulinus s.s. or the present section.

Bulinus forskalii (Ehrn.). (Pl. xv, f. 30.) Ref. List No. 520.

1831.  $Isidora\ forskalii\ Ehrn.,\ Symb.\ Phys.,\ Evert.,\ 3rd\ Sp.\ D.$ 

1898. ,, gradata M. & P., A.M.N.H., ii, p. 129, pl. vii, f. 8. D.F.

1922. Isidora forskali Ehrn., Dgnr., L.-u. S.-w. Fauna D.-Sw. A., Moll., p. 48. N.

1925.  $Isidora \ forskali$  Ehrn., Kay Sharp, Schistosomiasis, p. 13. D.F.R.

1925. Isidora forskali Ehrn., Conn., Trans. R. Soc. S. Africa, xii, p. 190. L.

1925. Isidora forskali Ehrn., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. F.R.

1925. Isidora forskali Ehrn., Cawst., Trans. R. Soc. S. Africa, xiii, p. 41, pl. iv, f. 5. N.F.R.

1926. Bullinus (Pyrgophysa) forskali Ehrn., Germ. & Nev.-Lem., Ann. Parasit., iv, p. 365. D.

1927. Bulinus (Pyrgophysa) forskalii Ehrn., P. & B., Bull. Amer. Mus. N.H., liii, p. 141, pl. xi, f. 9. N.F.

1929. Bulinus (Pyrgophysa) forskali Ehrn., Faust, Human Helminthology, p. 568.  $\,N.\,$ 

1929. Isidora (Pyrgophysa) forskalii Ehrn., Haas, Zool. Jahrb., lvii, p. 415. N.

1930. Bulinus forskali Ehrn., Conn., Ann. S.A. Mus., xxix, p. 316. N.

1931. Bulinus (Pyrgophysa) forskalii Ehrn., Beq. & Clench., Occ. Pap. Boston Soc. N.H., v, p. 365, pl. xviii, f. 15-16. D.F.

1931. Bulinus (Pyrgophysa) wahlbergi Krs., Beq. & Clench., ibid., p. 366, pl. xviii, f. 17. D.F.

(Only recent references of some importance and local interest are given above.)

Shell sinistral, of fair size, elongate turriform, dull, silky, usually corneous buff. Spire produced, sides usually straight, apex mamillate. Whorls 6, convex, regularly increasing, rounded at periphery, but usually with a more or less distinct ridge, forming a shoulder, a short distance below the suture; extreme apex engraved with microscopic dots, arranged in spiral but not radial rows, the general sculpture scheme on the succeeding whorls consisting of strong, straight, close or spaced vertical costae, with or without spiral lines, occasionally low ridges, between or crossing the vertical, but the pattern is extremely variable, the spirals frequently invisible and the vertical close or subdistant, and sometimes almost obsolete, on succeeding whorls of the same shell; suture deep. Aperture narrow acuminate ovate, peristome simple, labrum straight and vertical in profile, columella erect, margin very narrowly or adnately reflexed over the narrow rima, which it sometimes obliterates. A well-grown Durban example measures

Long. 11.7, lat. 4.2; apert. alt. 4.5, lat. 2.2; last whorl 7.4 mm.

Hab. TRANSVAAL. R. Limpopo (wahlbergi, Wahlberg); Pretoria (Farquhar).

NATAL. Pietermaritzburg; Thornville; frequent along south coast in Durban District, Port Shepstone, etc. (Cawston); Bushman's R., Weenen (Thomasset).

CAPE PROVINCE. Grahamstown (gradata, Farquhar); Mossel Bay; Port St. John's (Power); Pluto's Vlei, 18 miles east of Grahamstown (Smith).

DAMARALAND. Usakos (Frames); Neudamm; Teufelsbach, 25 km. S.S.E. of Okahandja (Michaelsen).

KAOKOVELD. Near Otjitundua (forma semiplicata Morel.) and

OVAMBOLAND. Ondongua (forma apiculata Morel.); Mafa, north of Ondongua; Ukualuthi (Barnard).

LORENZO MARQUES. Beira; Delagoa Bay (Cawston).

ZULULAND. Nonoti (Cawston).

Described from Egypt and occurring over nearly the whole of South and Central Africa as well as in the Comoro and Mascarene Islands. In addition to wahlbergi and gradata, various authors have placed in its synonymy jickelii Krs., nyangweensis Dup. & Putz., lamellosa Roth., vitrea Parr., fischeriana Bgt., beccarii Paladh., dunkeri Germ. (= scalaris Dkr.), schmidti Dkr., mariei Crosse, spiralis Fér., apiculata, capillacea, clavulata, semiplicata and turriculata Morel. It is probable too that dautzenbergi Germ., ludovicianus Mittre, moreleti and osorioi Nobre are merely forms of the same species.

Bequaert and Clench distinguish wahlbergi from forskalii by its more slender outline and deeply contracted suture, while Haas (1929) states his agreement with the present writer that all African species of *Pyrgophysa* should be united under the oldest name.

Subgenus *Physopsis* Krs., 1848 (Südafr. Moll., p. 85). Type *P. africana* Krs.

Shell relatively smooth and glossy, spire more or less blunt, seldom much exserted, aperture large, columella basally truncate, with little or no marginal reflection; mantle cavity with a second pair of longitudinal folds below the other pair.

Bulinus (Physopsis) africanus (Krs.). (Pl. xv, f. 42-43.) Ref. List No. 527.

1848. Physopsis africana Krs., Südafr. Moll., p. 85, pl. v, f. 14. D.F.

1914. Physopsis africana Krs. [cum var. ovoidea Bgt. (=leroyi Grandid. and stanleyana Bgt.)], Dautz. & Germ., Rev. Zool. Afr., iv, pp. 46, 47. N.

1916. *Physopsis africana* Krs., Becker, Med. J. S. Africa, xi, pp. 156, 157, f. 1. *N.F.* 

1917. Physopsis africana Krs., Cawst., Med. J. S. Africa, xii, pp. 183, 184, f. 3-4 (pessime). N.F.

1919. Physopsis africana Krs., Germ., Bull. Mus. Paris, p. 47. D.

1920. Physopsis africana Krs., Germ., Voy. Babault, p. 189. D.

1921. ,, ,, Cawst., Trans. R. Soc. S. Africa, ix, p. 302. N.

1922. Physopsis africana Krs., Cawst., Ann. Trop. Med. Parasit., xvi, p. 207. N.

1922. Physopsis africana Krs., Dup. & Putz., Ann. Soc. Zool. Belg., liii, p. 74. N.

1925. *Physopsis africana* Krs., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. *F.R.* 

1925. Physopsis africana Krs., Cawst., Ann. Trop. Med. Parasit., xix, p. 217, f. 1. F.

1925. *Physopsis africana* Krs., Cawst., Trans. R. Soc. S. Africa, xiii, p. 41, pl. iv, f. 3. N.F.R.

1925. Isidora (Physopsis) africana Krs., Conn., ibid., xii, p. 191. N.L.

1925. Physopsis conicum Porter, Proc. R. Soc. Med., xviii, p. 56. Nomen nudum.

1925. Isidora (Physopsis) africana Krs., Kay Sharp, Schistosomiasis, p. 11. D.F.R.

1926. Isidora africana Krs., Cawst., J. Trop. Med. Hyg., xxix, pp. 3, 177. N.F.

1926. Physopsis africana Krs., Germ. & Nev.-Lem., Ann. Parasit., iv, p. 366. D.F.

1927. Physopsis africana Krs., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 144, pl. xi, f. 6. D.F.

1927. Isidora africana Krs., Cawst., Ann. Trop. Med. Parasit., xxi, p. 36, pl. v, f. 3. N.F.

1927. Isidora africana Krs., Cawst., J. Med. Ass. S. Africa, i, p. 309. N.F.

1929. *Physopsis africana* Krs., Cawst., Trans. R. Soc. Trop. Med. Hyg., xxii, p. 335. N.

1929. Physopsis africana Krs., le Roux, 15th Rept. Vet. Serv. Union S. Africa, pp. 408, 436, f. 10–13. N.F.

1929. Physopsis africana Krs., var. globosa, le Roux, ibid., pp. 413, 435, f. 1–6. N.L.F.

1929. *Physopsis conicum* le Roux, *ibid.*, pp. 408, 435, f. 7-9. *N.L.F.* 

1929. Physopsis africana Krs., Faust, Human Helminthology, p. 568. N.

1930. Physopsis africana Krs., Conn., Ann. S.A. Mus., xxix, p. 317. N.

1932. Physopsis africana Krs., Blackie, Mem. London Sch. Trop. Med., v, p. 33. N.

1934. Physopsis africana Krs., Conn., Ann. Trop. Med. Parasit., xxviii, p. 442. N.

1936. Physopsis africana Krs. (=globosa Morel., ovoidea and stanleyana Bgt., leroyi Grandid. and tanganyicae Mts.), Haas, Abh. Senckenb. Ges., No. 431, p. 32. N.L.

Shell medium to large, imperforate, nearly smooth, glossy, bright corneous brown. Spire not much exserted, summit round or nearly flat. Whorls nearly 4, rapidly increasing, convex, rounded at periphery, 1st minute, bearing extremely faint, fine transverse microscopic wrinkles, 2nd with stronger transverse sculpture and microscopically engraved with punctate dots, arranged in regular radial and spiral lines, which usually disappear about the 3rd whorl, continuing as weak irregular spiral lines, that impart faint granulation to the surface by intersecting the very weak growth lines; suture simple. Aperture suboval, peristome simple, labrum very slightly recurved in profile, callus and columella white and glossy, latter usually thick and rather short, practically without marginal reflexion, prominently truncate at its base, which is a considerable distance above that of the aperture. The well-grown and perfectly preserved shell described, from South Coast Junction, Natal, measures

Alt. 16·2, lat. 10·2; apert. alt. 11·8, lat. 5·2; last whorl 15·3 mm., while a larger Durban example is  $18\cdot8\times11\cdot8$ , last whorl  $18\cdot0$  mm.

Hab. NATAL. Port Natal (type, Wahlberg); widely distributed, especially about the south coast.

ZULULAND (Burnup; Toppin).

CAPE PROVINCE. Knysna (Purcell); Port Elizabeth (Crawford); East London (Kincaid); Humansdorp (Cawston).

TRANSVAAL. Middelburg (Crawford); Pretoria District (Connolly and others); Magaliesburg; Rustenburg; Mulders Drift; Klerksdorp; Scheerpoort (Cawston).

BASUTOLAND. Morija (A. Porter).

S. RHODESIA. Gwelo (Dodds); Enkeldoorn District, Mashonaland (Miss Sharpe-Young).

(*Note*.—It is possible that these two localities refer to the following species.)

LORENZO MARQUES. Tette (Peters; Kirk; Penther); Lebombo Marsh (Junod); Wanetsi River, Magude District (Bell Marley).

(Note.—Here again, except for the last mentioned, most of these records are probably attributable to Physopsis globosa (Morelet).)

OVAMBOLAND. Upper reaches of Omuramba-Omataka River (Shortridge).

Type in Stuttgart Museum.

The columellar margin in this species is almost invariably adnate, without trace of rimation, but occasionally, especially in senile

examples, it is not entirely closed at its lower extremity, thus forming a minute chink. The shape of the summit in this, as in most others of the subgenus, varies considerably, according to even the smallest degree of exsertion of the apical whorls, and Dr. Porter kindly informs me that the true history of the undescribed, unsponsored, and wrongly engendered *Physopsis conicum* is as follows: Some years ago she submitted an assortment of freshwater shells for identification to an expert who informed her that he considered a small, short-spired form from Pretoria to represent a possibly new species, in which case he proposed to describe it under that name. Under the impression that this had been done, she made casual mention of the name in a display before the Royal Society of Medicine, and le Roux, in 1929, published excellent figures of this still-born species, which must pass into synonymy, and can only be attributed, under the rules of nomenclature, to his authorship.

Cawston records that  $Bul.\ africanus$  attains particularly large dimensions when able to feed on decaying sugar-canes.

## Bulinus (Physopsis) globosus (Morel.). (Pl. xv, f. 40-41.)

1866. Physa globosa Morel., J. de C., xiv, p. 162. D.

1868. *Physopsis globosa* Morel., Voy. Welwitsch, p. 93, pl. ix, f. 4. D.F.

1925. Isidora (Physopsis) globosa Morel., Conn., Trans. R. Soc. S. Africa, xii, p. 191, pl. viii, f. 8–15. N.A.R.

1925. Isidora (Physopsis) globosa Morel., Kay Sharp, Schistosomiasis, p. 14. D.F.

1925. *Physopsis globosa* Morel., Cawst., Ann. Trop. Med. Parasit., xix, p. 217, f. 2. F.

1929. Physopsis globosa Morel., Faust, Human Helminthology, p. 568. N.

1932. *Physopsis globosa* Morel., Blackie, Mem. London Sch. Trop. Med., v, p. 3, pl. i, f. 1–2. *N.F. Eggs*.

1934. *Physopsis globosa* Morel., Conn., Ann. Trop. Med. Parasit., xxviii, p. 443. N.F.

When describing this species, Morelet rightly stressed the fact of its slight rimation, which affords the only real and fairly constant point of difference between itself and africana. The shell sometimes attains large dimensions and extreme obesity, but the type is not ultra-globose and its dimensions present a fair average of well-grown individuals. The spire and other details are subject to the same variation in form as in africana, but the columella, although distinctly truncate at its base, is not entirely adnate to the body whorl, but leaves a small gap near its upper

extremity, which forms a minute slit or rima; all that I have seen of the type set (about 30) exhibit this feature, as do very many series from Central Africa, but in Rhodesia, and, I am told, the Belgian Congo, the difference between the two forms of columella becomes far less clear, possibly through interbreeding, and it is often difficult to assign the most appropriate name to individual specimens.

Alt. 20.0, lat. 13.5; apert. alt. 14.8, lat. 9.0; last whorl 17.5 mm.

Hab. LORENZO MARQUES. Lebombo Marsh, Rikatla (Junod); Delagoa Bay (Cawston).

S. RHODESIA. Darwin; Mazoe; Salisbury; Umtali; Melsetter and Chibi Districts (Blackie).

Described from Angola and widely distributed over Central Africa. Type in British Museum.

#### FAMILY ANCYLIDAE.

Shell small, conical, patelliform, or rarely planorboid, thin, corneous; tentacles short; mantle cavity broadly open below, but often reduced, a well-developed pseudobranch depending from its deepest part; jaw composed of numerous narrow plates arranged in a semicircle; penis often with an appendix.

### Subfamily Ferrissiinae.

Shell patelliform, apex normally more or less inclined to the right: animal sinistral; central tooth of radula usually with 4 cusps, of which 2 or 3 are very minute, laterals and marginals typically multicuspid; transverse rows of teeth straight or curving forward slightly on each side.

The descriptions which follow make it obvious that the exact nature and area of the apical sculpture in this subfamily are of primary importance in specific determination, and as even in long series which I have examined from certain localities the apex is entirely ruined by erosion, I have omitted their records from those now appended.

> Genus Burnupia Walker, 1912 (Nautilus, xxv, p. 139). Type Ancylus caffer Krs.

Shell patelliform, apex posterior, prominent and inclined to the right, radially punctate; central teeth of radula symmetrical with 2 main cusps, laterals usually with 3 major cusps, endocone and mesocone more or less united, frequently with additional small cusps on either side of ectocone; inner laterals slightly larger than the outer, which merge into the marginals by progressive splitting up of the cusps. 33

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Cawston states that in feeding the radula is thrown out over the surface of the food. The front rows of teeth are buried in the foot and escape the full force of contact with the food, and the central tooth of each row is slightly overridden by the laterals, so that it hardly comes into play. Hence he infers that the cones of the extreme front rows of teeth and of the centrals of each row are ill-developed and resemble those in the embryonic radula.

Little is known of the anatomy of this genus except its radula. The diversity of this organ shows that the species should probably be arranged in two groups, one including caffra, gordonensis, brunnea, farquhari, capensis natalensis, and mooiensis, and the other, stenochorias, transvaalensis apicata, etc., and Walker arranged the species accordingly, but I have preferred to place them in the sequence suggested by their conchological characters, which are more easily studied by collectors.

Burnupia caffra (Krs.). (Text-fig. 45.) Ref. List No. 506.

1848. Ancylus caffer Krs., Südafr. Moll., p. 70, pl. iv, f. 13. D.F.

1855. ,, *obliquus* Krs., Küst., Conch. Cab., pl. i, f. 18–20. *F*.

1859. , gaulus Gld., Proc. Boston Soc. N.H., vii, p. 40. D.

1923. Burnupia caffra Krs., Walk., Ancylidae S.A., p. 30, pl. i, f. 1-2. D.F.R.

1923. Burnupia caffra Krs., Cawst., Trans. R. Soc. S. Africa, xi, p. 124. L.

1926. Burnupia caffra Krs., Walk., Occ. Pap. Mus. Zool. Univ. Mich., No. 175, p. 5, pl. ii, f. 4. R.

1927. Burnupia caffer Krs., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 152, pl. xii, f. 3. D.F.

Shell of fair size, oval elliptical, left and anterior slopes much arched, right small and steep, right margin somewhat less curved than left, posterior below base of apex nearly perpendicular, apex more or less short and blunt, situate one-fourth of the shell's length from rear, inclined to right, usually vertically above, but not protruding beyond the right margin, distinctly radially punctate as far as 1st concentric growth line, from which point the latter are close, strong and regular, somewhat rugulate owing to being crossed by radial lines.

Long. 5.4, lat. 3.8, alt. 2.57 mm.

Hab. NATAL. Pietermaritzburg (caffra, fide Krauss); Imputshini and Inkwalini streams near Maritzburg; Umkomaas (Burnup); Port Natal (obliquus, Wahlberg); Umgeni; Westbrook's Farm near Duff's Road; Avoca; Umlalasi; Umhlanga; Umhlangana (Cawston).

CAPE PROVINCE (gaulus, Stimpson).

Type of caffra in Stuttgart, gaulus in Washington Museum.

The actual type of caffra measures  $5.5 \times 4.0 \times 2.5$  mm. and the type label also bears the words "früher A. obliquus," leaving no doubt as

to the two names being synonymic, Krauss having originally distributed his shells under the latter, and withdrawn it when he realised that it was preoccupied by Broderip and Sowerby, TEXT-FIG. 45. - Burnupia caffra 1832. The radula here figured (text- (Krs.), paratype, original of A. obliquus Krs., Port Natal. Teeth from radula; × 600 approximately. collected by Wahlberg, now in my



collection, has the formula  $(12+8+1+8+12) \times 105 + \text{nascent}$ , laterals changing to marginals at No. 9, outermost marginals small and rudimentary.

## Burnupia gordonensis (M. & P.). Ref. List No. 506 (pars).

1903. Ancylus gordonensis M. & P., A.M.N.H., xii, p. 606, pl. xxxi, f. 2. D.F.

1923. Burnupia gordonensis M. & P., Walk., Ancylidae S.A., p. 34, pl. i, f. 3. D.F.R.

1925. Burnupia gordonensis M. & P., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. F.R.

1932. Burnupia gordonensis M. & P., Cawst., S. Afr. J. Sci., xxix, p. 613. R.

Shell large, ovate, anterior margin more broadly rounded than posterior, left slightly more convex than right, left and front slopes convex, right and rear concave, apex two-sevenths of length from rear and about midway between median line and right margin, short, abruptly bent down at tip but not overhanging margin, only extreme apex radially punctate, concentric striae as in *caffra* but radial finer. The paratype figured by Walker is  $7 \times 5 \cdot 25 \times 2 \cdot 66$  mm. in length, breadth, and height, but the largest example from Grahamstown is  $10 \times 6.5 \times 4.75$ , and another, less compressed and more normal,  $9 \times 6.5 \times 4.75$  mm.

Hab. NATAL. Gordon Falls (type), Town Bush Valley and Sweetwater streams, Maritzburg; Nottingham Road (Burnup); Karkloof (Burnup and Morton, fide Walker); Gwen Spruit, Hilton (Falcon); Umbilo; Umbogintwini; Umhlatuzana; Umhlanga; Umhlangana; Umhloti; Tongaat; Sarnia; Pinetown; Verulam (Cawston).

CAPE PROVINCE. Grahamstown (Kincaid; Cawston); Alicedale; Baakens River, Port Elizabeth (Cawston).

Type in British Museum.

Larger than *caffra* with shorter, less beaked apex, not overhanging margin, left and fore slopes less convex, right and rear more concave.

Radula, as figured by Walker, somewhat similar to that of caffra, formula approximately 18 + 11 + 1 + 11 + 18.

My specimens from Karkloof, ascribed by Walker to this species, appear to belong to *ponsonbyi*.

Burnupia stenochorias (M. & P.). Ref. List No. 506 (pars).

1903. Ancylus stenochorias M. & P., A.M.N.H., xii, p. 607, pl. xxxi, f. 1. D.F.

1923. Burnupia stenochorias M. & P., Walk., Ancylidae S.A., p. 53, pl. i, f. 14–15.  $\,$   $\,$   $\,$   $\,$   $\,$   $\,$  D.F.R.

1925. Burnupia stenochorias M. & P., Cawst., J. Trop. Med. Hyg., xxviii, p. 15. R.

Shell large, oval, elevated, slightly wider behind, left and front slopes convex, latter rather long, rear more concave than right, apex in posterior fourth of length, very prominent, slightly beaked and moderately inclined, nearly overhanging margin, micropunctate sculpture very strong, radial stronger than concentric. A normal paratype measures  $8.5\times6.0\times3.5$  mm.

Hab. CAPE PROVINCE. Ebb en Vloed (type) and other localities near Port Elizabeth; Kingwilliamstown Road Dam, Kowie River and other localities near Grahamstown; Fish River, Cradock (Farquhar); Upper Retreat and Klipplatz R., Cathcart (Miss Hickey); Käser R., Montagu (Connolly); Alicedale (Cawston); Sabatele, St. Marks, Transkei (Swan); East London (Kincaid).

NATAL. Avoca; Umhlangana (Cawston).

ORANGE FREE STATE. Glen (Bigalke).

Type in British Museum.

Formula of radula figured by Walker approximately 15+12+1+12+15, change from laterals to marginals occurring gradually between Nos. 9 and 13; the first 8 laterals are remarkable in the concrescence of endocone and mesocone into a single large cusp that projects below the base, apparently resembling in this respect the radulae of the Central African kempi and crassistriata Preston and South African transvaalensis apicata.

The shell is larger than caffra, apex more prominent, elevated and acute, radial sculpture usually stronger; it is more oval than gordonensis, with more acute and elevated apex, extending nearer the margin.

## Burnupia trapezoidea (O. Bttg.). Ref. List No. 506 (pars).

1897. (?) Ancylus caffer Krs., Mts., D.-O.-Afr., p. 151, pl. i, f. 19, a, c, d. D.F.

1907. Ancylus trapezoideus Bttg. in Schultze, Aus Namaland u. Kalahari, p. 708. N.

1910. Ancylus trapezoideus Bttg., Abh. Senckenb. Ges., xxxii, p. 450, pl. xxviii, f. 15. D.F.

1923. Burnupia trapezoidea Bttg., Walk., Ancylidae S.A., p. 57, pl. i, f. 16-17. D.F.

1930. Burnupia trapezoidea Bttg., Conn., Ann. S.A. Mus., xxix, p. 317. N.

Shell large, much elevated, narrow oval, ends almost equally rounded, right margin slightly less curved than left, right and rear slopes almost straight below base of apex, left a little more convex than front, apex about one-third of length from rear, on right of median line, little beaked but more or less strongly inclined to right, sometimes protruding beyond margin, punctate area extremely small, dots faint, concentric sculpture fine, close and regular, crossed by regular, raised rays, stronger towards the margin. Walker gives dimensions ranging from  $9 \times 6.25 \times 2.75$  and  $8.5 \times 6 \times 3$  (which he considers normal) to  $8.5 \times 5 \times 3.25$  and  $8 \times 5.33 \times 3$  mm., but I have found the higher, more compressed form more usual.

Hab. BECHUANALAND. Witkop (type, subfossil, Schultze). ORANGE FREE STATE. Valsch R., Lindley (Connolly); Schuttes Draai (Cawston); Modder River (Kimberley Museum).

TRANSVAAL. Pretoria District (McBean); Zoutpansberg (Cregoe); Wonderboom (A. Porter); Crocodile R. Drift (Connolly). GRIQUALAND WEST. Newlands and Riet River (Swan);

Postmasburg (Power).

BRITISH BECHUANALAND. Matopa Pan, Ngamiland (subfossil, Rogers).

KAOKOVELD. Kamanyab (subfossil, Barnard).

Also chronicled by Martens from Central Africa.

Type in Senckenberg Museum.

The shell is generally higher and far narrower than others of the genus, and remarkable for its much inclined excentric apex; a very immature series collected by Michaelsen at Neudamm in Damaraland and Seeheim in Great Namaqualand, which, from the locality, might be provisionally referred to this species, appear, from what I have seen of them, to have almost too blunt an apex.

## Burnupia transvaalensis (Crvn.). Ref. List No. 508.

1880. Ancylus transvaalensis Crvn., P.Z.S., p. 617, pl. lvii, f. 11. D.F.

1923. Burnupia transvaalensis Crvn., Walk., Ancylidae S.A., p. 62, pl. i, f. 18. D.F.

1927. Burnupia transvaalensis Crvn., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 154, pl. xii, f. 1. N.F.

Shell large, broadly oval, not greatly elevated, lateral slopes nearly equally convex, anterior more so, posterior straight, apex rather more than half-way from fore end, slightly to right of median line, small, not beaked, and little inclined, punctate area large, dots very coarse, concentric striae coarse and low, slightly and rather irregularly wrinkled by extremely weak radiation. The type measures  $7.5 \times 5.3 \times 3.2$ , while an Irene example is  $8.0 \times 5.5 \times 3.5$  mm.

Hab. TRANSVAAL. Mooi River (type, Craven); Irene, 8 miles south of Pretoria (Connolly); Krüger Park (Haas).

Type in British Museum.

Nearest to *gordonensis*, from which it differs mainly in its shorter, less excentric apex.

var. apicata Walker.

1923. Burnupia transvaalensis apicata Walk., Ancylidae S.A., p. 64, pl. i, f. 19. D.F.R.

Smaller than type, with more erect, acute and excentric apex, fore slope more convex and rear more nearly vertical, apical punctation very strong and coarse, concentric sculpture very weak, with scarcely a vestige of radiation. The type measures  $5 \times 3 \cdot 6 \times 2 \cdot 5$ , and two other shells  $5 \cdot 5 \times 4 \times 2 \cdot 75$  and  $5 \cdot 5 \times 4 \cdot 25 \times 2 \cdot 25$  mm.

Hab. ORANGE FREE STATE. Vaal River, Boshof (type, Swan). TRANSVAAL. Vereeniging (Johnson).

CAPE PROVINCE. Prieska (coll. Ponsonby).

GRIQUALAND WEST. Rooipoort; Vaal R., Kimberley (Kimberley Museum).

Type in coll. Walker.

Radula formula approximately 12+12+1+12+12, the teeth resembling closely those of *stenochorias*; 7 bicuspid laterals, merging gradually to marginals from Nos. 8 to 14.

## Burnupia brunnea Walker.

1923. Burnupia brunnea Walk., Ancylidae S.A., p. 38, pl. i, f. 4. D.F.R.

Shell small, generally similar to apicata in shape, but larger, proportionately wider, apex less acute and more declined at tip, fore slope more convex and rear

more concave, punctate sculpture not decipherable, concentric strong and regular, radial distinct in type set but practically absent in those from other localities. The type measures  $6 \times 4.33 \times 2.75$  mm.

Hab. TRANSVAAL. Zoutpansberg (type, Cregoe); Atholl, Carolina (Mrs. Forbes); Louis Trichardt (in South African Museum).

NATAL. Dargle, Umgeni system (Taynton).

Type in coll. Walker.

The radula proves this species distinct from the last; its approximate formula is 13 + 10 + 1 + 10 + 13, laterals grading from No. 11 into marginals.

> Burnupia nana (Walker). Ref. List No. 506 (pars).

1912. Ancylus caffer Krs., var. nanus Walk., Nautilus, xxv, p. 139. D.

1923. Burnupia nana Walk., Ancylidae S.A., p. 39, pl. i, f. 5. D.F.

Shell small, suboval, front and rear margins about equally curved, left a little more so than right, front and left slopes convex, rear straight and little oblique below base of apex, right nearly vertical above but slightly splayed near its base, apex between one-third and one-fourth of length from rear and half-way between median line and margin, tip declined but little beaked and not reaching margin, punctate area small, arrangement of dots undecipherable, concentric sculpture strong and fairly regular, radial practically absent. The type measures 4.5 × 3.4 × 1.75, and two larger shells from another branch of the Karkloof River  $5.25 \times 4 \times 2.25$  and  $5.25 \times 3.3 \times 2.5$  mm.

Hab. NATAL. Karkloof Stream (type, Taynton); Pietermaritzburg (Ponsonby); Edendale Falls (Burnup).

TRANSVAAL. Fountains, Pretoria (Cawston).

Type in coll. Walker.

Somewhat resembling gordonensis in shape and proportions, but not approaching it in size.

## Burnupia farquhari (Walker). Ref. List No. 506 (pars).

1912. Ancylus caffer Krs., var. farquhari Walk., Nautilus, xxv, p. 140. D.

1923. Burnupia farguhari Walk., Ancylidae S.A., p. 41, pl. i, f. 6.

Shell small, broad oval, left side only slightly more curved than right, front and left slopes little convex, rear straight and oblique below base of apex, right nearly straight below base of apex, which is situate almost on median line in onethird or more of length from rear, rather blunt, hardly declined at tip and but little turned to right, punctate area small, dots undecipherable, concentric sculpture close and regular, rippled by the radial. The type is  $4.8 \times 3.75 \times 2$  and the largest example from Bulwer  $6.5 \times 5 \times 2.75$  mm.

Hab. CAPE PROVINCE. York, East Griqualand (type, Farquhar); Teko River, Transkei (Miss Hickey); East London (Kimberley Museum); Buffalo River (Warren); Alice (Kincaid); The Gorge, Somerset East (Mrs. Howard); Baviaans Kloof, Willowmore (J. Nortje).

NATAL. Bulwer (Burnup).

Type in coll. Walker.

Smaller than *brunnea*, proportionately wider, with more acute, less declined and excentric apex. Radula formula approximately 13+6+1+6+13.

Burnupia ponsonbyi Walker.

1923. Burnupia ponsonbyi Walk., Ancylidae S.A., p. 51, pl. i, f. 12. D.F.

Shell large, broad ovate, nearly circular, front slope only slightly convex, a little flattened towards tip of apex, rear and right nearly straight, former slightly incurved at base of apex, left slightly convex, apex acute, erect, not beaked and only very slightly turned to right, about one-third of length from rear, nearly on median line, punctate area small, the unique type is said to have fine, regular growth lines, scarcely rippled towards the peritreme, without any radial sculpture, but in most examples to hand, identified by Walker, the concentric growth lines are very strong and the radial lines vary from very weak to same strength as the former. The type measures  $6.75 \times 5.5 \times 2.5$  mm.

Hab. NATAL. Umgeni River (type); Aasvogel Krantz and Howick Falls (Burnup); Hilton (Falcon); Karkloof (Taynton); Bushman's River; Mooi River (Cawston).

Type in coll. Walker.

Walker does not define the apical sculpture, and I have not seen a specimen without eroded apex, but the wider, rounder, more depressed shell with strong concentric sculpture renders this species easily distinguishable.

var. diminuta Walker.

1923. Burnupia ponsonbyi diminuta Walk., Ancylidae S.A., p. 53, pl. i, f. 13. D.F.

Shell small, broad oval, not much elevated, both ends about equally rounded and lateral margins equally curved, left slightly more so, fore slope slightly convex, rear straight and not very oblique from base of apex, lateral nearly straight, apex about one-third length from rear, only a little to right of median line, rather blunt, not beaked, scarcely inclined to right, punctate area small, dots small and shallow, first 4 or 5 in each row single and then splitting into two and diverging gradually for about 5 or more pairs, when they fade away, concentric lines coarse and low, slightly rugulate.

Long. 4.25, lat. 3.5, alt. 1.75 mm.

Hab. TRANSVAAL. Christiania, Vaal River (Turton). Type in coll. Walker.

I agree fully with Walker in his suggestion that, coming from totally distinct drainage systems and possessing certain differences in the shell, this may be a distinct species, but its anatomy is available for

study, and pending that being published and knowledge of the microapical sculpture of *ponsonbyi* being obtained, it may be inadvisable

to disturb his arrangement.

Burnupia capensis (Walker). Ref. List No. 506 (pars).

1912. Ancylus caffer, var. capensis Walk., Nautilus, xxv, p. 141. D. 1923. Burnupia capensis Walk., Ancylidae S.A., p. 43, pl. i, f. 7. D.F.

Shell of fair size, oval, varying much in breadth, left and fore slopes convex, latter somewhat flattened towards apex, right and rear concave, apex about one-third length from rear, prominent, subacute, strongly turned to right, sometimes extending beyond margin, more or less beaked, punctate area rather large, dots coarse and somewhat irregular, concentric striae strong, close and regular, radial varying from rather weak to equal strength with the growth lines.

The type measures  $7.5 \times 4.5 \times 2.5$  mm., but variation in contour is great, the

most slender specimen from Port Alfred being 5.75 × 2.8 × 2.1 mm.

Hab. CAPE PENINSULA. Lakeside (type); Hout Bay (Connolly).

CAPE PROVINCE. West Hill and Blaauwkrantz Rivers, Grahamstown (Farquhar); Sabatele, St. Marks, Transkei (Kimberley Museum); East London; Cold Springs, Albany District (Kincaid); Rufanes River, Port Alfred (Hewitt); Ngaanduti, Tembuland (G. Trow); Port Alfred (Turton); vlei deposit near coast, Cape St. Francis (subfossil, Rogers); Oudtshoorn (Miss Wilman); Boschluis Kloof, Zwartberg Range, Prince Albert; Toontjes R., Naudesberg, Worcester; Keurbooms R. (Barnard); Hemel-en-Aarde, Caledon District (Rennie).

Type in coll. Walker.

This well-marked species is generally found on rushes, and in rapid streams is as a rule narrower than in stiller waters, though not constant in this respect. The strongly turned apex, oval contour, and usually strong radial sculpture combine to distinguish it from any of the foregoing species. It is a characteristic form of the Cape littoral, usually found among rushes and ranging from Hout Bay on the west to the Transkei; further inland it usually develops into the highly sculptured form *striatissima*, while further eastwards, in Natal, it is replaced by the variety *natalensis*; Walker mentions that his series from West Hill R., Grahamstown, and East London have the radial

striae more strongly developed than in the type, while those from the last two localities cited above are very highly radially striate, merging into the sub-species which follows; the fossil from Cape St. Francis is remarkable for the long, pointed tip to its beak, which might justify separation if found to be constant in a sufficient series.

#### sub-species striatissima Pilsb.

1932. Burnupia capensis striatissima Pilsb., Nautilus, xlv, p. 136. D.

1932. Burnupia capensis striatissima Pilsb., Cawst., S. Afr. J. Sci., xxix, p. 612. L.

"The shell is brown, higher than B. capensis Walk., with very close, strong radial striation, stronger than in any described African species. Apex strongly recurved, close to or overhanging the right side.

"Length 8·2, width 5·3, alt. 4·0 mm.
,, 7·3 ,, 4·5 ,, 3·4 ,, ."

Hab. BASUTOLAND. Quthing, among rushes used for thatching huts (type, Cawston).

CAPE PROVINCE. Belmont Valley, Grahamstown (Hewitt).

Type in Academy of Natural Sciences, Philadelphia.

I have nothing to add to Pilsbry's differentiation, with which I fully concur; were it not that all intermediates in strength of sculpture appear to exist in *B. capensis*, it would have been easy to regard this large, highly striate form as specifically distinct.

## sub-species natalensis Walker.

1923. Burnupia capensis natalensis Walk., Ancylidae S.A., p. 45, pl. i, f. 8. D.F.R.

Smaller and proportionately broader than type, more broadly rounded before than behind, with more excentric and strongly declined apex; sculpture in both forms substantially the same.

Long. 5.8, lat. 4.3, alt. 2.0 mm.

Hab. NATAL. Umhlatuzani R., Malvern (type); Sarnia; Avoca; Sea View; Black Ridge, Verulam Road; Umbogintwini; Tongaat; Gingindhlovu; Nonoti R., Darnall; Escombe; Oribi Flats; Park Rynie; Pinetown; Umvonga R., Margate; Shongweni Ridge, a small race on rocks in swift stream (Cawston); Umhlali (Alexander); Equeefa (Burnup).

ZULULAND. Eshowe (Cawston).

CAPE PROVINCE. Kokstad (Cawston).

Type in coll. Walker.

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"A small well-marked form characteristic of the small streams of the Natal littoral." Radula formula approximately 10+9+1+9+10, mesocone of inner laterals large.

## Burnupia verreauxii (Bgt.).

Ref. List No. 509.

1853. Ancylus verreauxii Bgt., Rev. et Mag. Zool., p. 351. D. 1923. Burnupia ,, ,, Walk., Ancylidae S.A., p. 50, pl. i, f. 11. D.F.

Shell rather small, not much elevated, ovate, fore margin broader than rear, left more curved than right, left and fore slopes little convex, latter flattened towards apex, right and rear more or less concave, apex about one-third length from rear and nearer right margin than median line, prominent, more or less beaked, well turned to right and sometimes extending to margin, punctate area extremely small, dots small but coarse, very faint at end of rows, remaining surface covered with very close, weak, regular concentric, crossed by far weaker radial lines, the whole presenting a smoother appearance than usual. A Retreat example is  $6\cdot 2\times 4\cdot 3\times 1\cdot 75$  mm.

Hab. CAPE PENINSULA. Ville de Constance (Constantia, type, Verreaux); Retreat (Connolly).

TRANSVAAL. Potchefstroom (Cawston); Wonderboom (Robinson).

Type in Geneva Museum.

Recognisable by smooth surface, acute excentric apex and comparative flatness of left and front slopes; the Transvaal examples are said to be rather more elevated than type, with blunter apex, but apparently belong to the same species.

## Burnupia mooiensis (Walker).

Ref. List No. 507.

1912. Ancylus mooiensis Walk., Nautilus, xxv, p. 141. D. 1923. Burnupia ,, ,, Ancylidae S.A., p. 47, pl. i, f. 9.

D.F.R.

Shell large, elevated, slightly obovate, ends nearly equally rounded, left margin a little more so than right, front and left slopes more or less convex, rear long, regularly but not deeply concave, right slightly so half-way down, apex about one-third length from rear and half-way between median line and margin, subacute, not strongly beaked, more or less turned to right but seldom extending near margin, punctate area large, first 4 or 5 dots in each row single, next 5 double, growth lines strong, crossed by equally strong wavy radials. The type is  $6\cdot25\times4\times2\cdot5$  and my largest topotype  $7\times5\cdot2\times3\cdot0$  mm.

Hab. TRANSVAAL. Mooi River, Potchefstroom (type, Miss Livingston; Cawston).

Type in coll. Walker.

Nearest perhaps to the broader and typical form of *capensis*, in which, however, the punctate area is smaller and the dots seldom, if ever, split into two. Radula formula approximately 11+7+1+7+11.

#### var. dubiosa Walker.

#### Ref. List No. 507.

1912. Ancylus mooiensis, var. dubiosus Walk., Nautilus, xxv, p. 142. D.

1923. Burnupia mooiensis dubiosa Walk., Ancylidae S.A., p. 49, pl. i, f. 10. D.F.

Narrower than type, apex more obtuse, little beaked, only very little turned to right, punctate area smaller, and in the type set, which are somewhat eroded, I cannot detect any doubling of the dots. The type is  $5.25 \times 3 \times 2$  mm.

Hab. TRANSVAAL. Pienaars Poort, 15 miles east of Pretoria (type, Connolly); Mooi River, Potchefstroom, and vlei above dam (Cawston).

Type in coll. Walker.

### Burnupia vulcanus Walker.

1923. Burnupia vulcanus Walk., Ancylidae S.A., p. 66, pl. ii, f. 22. D.F.

Shell small, conical, rather depressed, regularly oval, ends equally rounded, sides about equally curved, left slightly more so, front slope nearly straight, rear oblique and straight below base of apex, laterals nearly straight, apex about one-third length from rear, prominent, subacute, erect and only slightly excentric, quite blunt at tip with a large apical depression, punctation large for size of shell, concentric lines fine and regular, radial close, coarse, somewhat irregular; the two specimens known measure  $3\times2\times1.5$  and  $3\times2\times1.25$  mm.

Hab. TRANSVAAL. Mooi River, Potchefstroom (Cawston).

Type in coll. Walker.

"The oval, conic shape, striated slopes and large apical depression remind one of the cone of a volcano, and hence the specific name."

## Burnupia obtusata Walker.

1926. Burnupia obtusata Walk., Occ. Pap. Mus. Zool. Univ. Mich., No. 175, p. 4, pl. i, f. 6-7. D.F.

Shell small, rather depressed, broad oval, ends equally rounded, sides regularly curved, left more than right, front slope only slightly curved, rear nearly straight and only slightly oblique, right straight and oblique, left slightly convex, apex about one-fourth length from rear, prominent, excentric, nearly reaching margin, obtuse, nearly flat at tip, which appears as though obliquely truncate, with well-defined apical depression, micropunctation rather large, concentric sculpture fine and regular, radial irregular, rather coarser towards apex. The unique type measures  $2.75\times2\times0.8$  mm.

Hab. NATAL. Bishopstowe Road, Pietermaritzburg (type in coll. Walker).

"Peculiar in its depressed, almost subcircular form and flattened, truncated tip of the apex"; differs from *vulcanus* in shape, position of apex and smoother surface.

Genus Ferrissia Walker, 1903
(Nautilus, xvii, p. 15).

Type Ancylus rivularis Say
(=Haldemania Cless., 1880, non Tryon, 1862).

Shell small, more or less depressed, usually rather narrow; apex radially striate, posterior, more or less inclined to the right. Central tooth of radula with two almost symmetrical mesocones and two very minute ectocones; laterals differing little from marginals, having smaller cusps than in *Burnupia*; outer laterals larger than the inner, but marginals decreasing again in size.

In some cases half-grown individuals may form, probably during aestivation, a septum across the posterior half of the base, and when growth is renewed it occurs around the aperture left in front of this septum, so that the adult looks as if it had a small shell attached, somewhat obliquely, to the top of the hinder part of a larger one. The two South African species at present known sometimes to form this septum have usually been placed in a separate genus, together with *F. equeefensis* Walker, but this would appear to be unjustifiable, judging from the following account by Watson, which he allows me to quote:

"Ferrissia appears to be quite distinct from Burnupia, although Thiele only separates it subgenerically. It is very closely related to Gundlachia Pfr., and Walker (1924) placed three of the South African species in the latter genus. The true species of Gundlachia, however, seem to be confined to Central and South America and the West Indies, and are distinguished by the smooth apex of the shell and the great difference in size of the two main cusps of the central tooth of the radula—features which have not been found in any of the South African species. Pilsbry and Bequaert (1927) placed in Kincaidilla Hannibal two of the species that Walker assigned to Gundlachia, namely F. farquhari and F. equeefensis, although only one of these is known to form a septum; but Hannibal instituted Kincaidilla for certain Nearctic species which he said differed from Ferrissia in their 'narrowly elliptical outline and high strongly inclined apex,' whereas

these two species are of the same form as the other South African species of Ferrissia, to which they are likely to be more nearly related than to any of the North American species. It is true that Walker enlarged the group, which he called Kincaidella, to include all the species with radially striated apices that were known to form septa, together with a few others with similar radulae, because he erroneously supposed that all these species had a type of radula differing from that of the other species of Ferrissia and agreeing with that of Gundlachia, of which he regarded Kincaidella as a subgenus. But this is the exact opposite of the truth; Walker was apparently misled by inaccurate drawings, and his classification of these forms should therefore be rejected. Moreover, the fact that septate forms with radially striated apices are found occasionally throughout those regions of the world in which similar non-septate forms occur, but not elsewhere, supports the evidence of the radula that they all belong to the same genus; just as the geographical distribution and radulae of the species of Gundlachia and Hebetancylus suggest that they also belong to a single genus. In any case, unless some difference should be revealed when the other organs are made known, it would be quite impossible to divide the South African species into those that can sometimes form a septum and those that cannot, as we do not know which, if any, of the species cannot become septate in any circumstances."

I will deal first with those species that are not yet known to form septa, though it is possible that one or two of them may prove to be the non-septate forms of the species that do.

## Ferrissia burnupi (Walker). Ref. List No. 510.

1912. Ancylus burnupi Walk., Nautilus, xxv, p. 142. D.

1923. Ferrissia ,, ,, Ancylidae S.A., p. 67, pl. ii, f. 23. D.F.R.

1925. Ferrissia burnupi Walk., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. R.

Shell small, depressed, narrow oval, normally bluish white, ends about equally rounded, sides nearly parallel, hardly convex, front and left slopes slightly convex, right and rear nearly straight, apex one-fourth or less of length from rear, slightly to right of median line, obtuse, scarcely projecting and slightly turned to right, very finely radiately striate from extreme apex, later concentric sculpture regular but weak, radial almost absent. The type measures  $4 \times 2 \cdot 2 \times 1$  mm.

Hab. NATAL. Equeefa (type, Burnup); Sarnia; Avoca, Umhlangana R.; Mayville; Sydenham; Botanical Gardens, Durban;

Umbilo; South Coast Junction; Malvern; Scottburgh; Pietermaritzburg (Cawston).

TRANSVAAL. Six Mile Spruit, Pretoria (Cawston).

Type in coll. Walker.

Radula formula approximately 16+1+16, teeth increasing gradually in size to about the 7th and then decreasing again towards margins.

The somewhat depressed shell with blunt, slightly turned apex affords a basis for comparison between this and the ensuing species.

## Ferrissia connollyi (Walker). Ref. List No. 511.

1912. Ancylus connollyi Walk., Nautilus, xxv, p. 143. D.

1923. Ferrissia ,, ,, Ancylidae S.A., p. 69, pl. ii, f. 24. D.F.

Shell small, subconic, oval, pale corneous brown, sides nearly parallel, left slightly more convex, front and left slopes slightly convex, right and rear nearly straight, apex about one-fifth of length from rear, just to right of median line and slightly turned to right, obtuse and prominent, radiate for only a short distance from extreme apex, concentric sculpture weak and rather irregular, radial only faintly apparent near margins.

Long. 3.75, lat. 2.2, alt. 1.5 mm.

Hab. CAPE PROVINCE. Black River, Maitland, near Cape Town (type, Connolly); Kingwilliamstown Road Dam (Farquhar) and Slaai Kraal Road, Grahamstown (Kincaid).

NATAL. Umbilo River, Sarnia (Cawston).

Less depressed than burnupi, front slope more convex and apex more prominent.

#### Ferrissia cawstoni Walker.

(Pl. xvi, f. 13–15.)

1923. Ferrissia cawstoni Walk., Ancylidae S.A., p. 70, pl. ii, f. 25-26. D.F.

1932. Ferrissia cawstoni Walk., Cawst., S. Afr. J. Sci., xxix, p. 613. N.

Shell small, subconic, long oval, almost imperceptibly wider anteriorly, pale greenish blue; ends nearly equally rounded, sides very little curved, front slope slightly convex, rear straight and oblique from base of apex, right and left nearly straight, latter a little the more oblique, apex prominent, obtuse, about one-fourth length from rear, nearly on median line and scarcely turned to right, with strong rugate micro-radial lines extending from extreme apex across the earliest growth lines, which are very fine and slightly irregular, rippled by weak radial striolae. The type measures  $4\cdot25 \times 2\cdot5 \times 1\cdot5$  and a larger topotype  $5\cdot1 \times 3 \times 1\cdot75$  mm.

Hab. TRANSVAAL. Mooi River, Potchefstroom (type); Klerksdorp; Hex R., Rustenburg; Damar; Mulders Drift; Six Mile Spruit (Cawston) and Aapies River, Pretoria (Robinson).

BASUTOLAND. Mafeteng (Cawston).

ORANGE FREE STATE. Parys (Cawston).

Type in coll. Walker.

Larger and comparatively more elongate than *connollyi*, with more acute and less excentric apex, at base of which the rear slope is slightly more incurved; micro-apical radii far stronger and more wrinkled than in *burnupi*.

#### Ferrissia lacustris Walker.

1923. Ferrissia lacustris Walk., Ancylidae S.A., p. 71, pl. i, f. 20. D.F.

Shell small, conical, long oval, very pale horn colour, side margins nearly parallel, little convex, left slightly more so, front slope convex, slightly declined towards apex, rear short, right nearly straight, left more oblique and slightly convex, apex about one-fourth of length from rear, slightly to right of median line, a little turned to right, obtuse, not prominent, radially striate, growth lines fine and regular, varying in strength.

Long. 4.5, lat. 2.75, alt. 1.75 mm.

Hab. TRANSVAAL. Lake Chrissie (Cawston).

Type in coll. Walker.

Longer and a little wider proportionally than *connollyi*, with less prominent apex, which is more obtuse and excentric than in *burnupi*; said to be proportionally wider than *cawstoni*, with more obtuse, less elevated apex, front slope more convex, laterals more oblique.

## Ferrissia fontinalis (Walker). Ref. List No. 513.

1912. Ancylus fontinalis Walk., Nautilus, xxv, p. 144. D. 1923. Ferrissia ,, ,, Ancylidae S.A., p. 73, pl. ii, f. 27. D.F.

Shell very small, pale grey, depressed, oval, lateral margins nearly straight, ends about equally rounded, front slope nearly straight, rear oblique, straight below base of apex, laterals oblique, nearly straight, slightly splayed toward margins, apex about one-fourth of length from rear, more or less to right of median line, rounded, only slightly turned to right, extremely closely rugosely radiate, the rays gradually fading away on the later, closely and weakly concentrically striate surface.

Long. 3.25, lat. 1.8, alt. 0.8 mm.

Hab. TRANSVAAL. Randjesfontein (type); Pienaars Poort

(Connolly); Wonderboom (Robinson; A. Porter); Mooi River, Potchefstroom (Cawston).

ORANGE FREE STATE. Morgendal; Lindley (Connolly).

NATAL. Durban; Bellair; Sydenham; Umgeni Mouth; Prospect Hall (Cawston).

Type in coll. Walker.

A somewhat unsatisfactory little species, which may possibly represent the young stage or stunted race of more than one larger form since it is impossible to decipher the apical sculpture on shells from several localities, owing to erosion or irremovable incrustation.

#### Ferrissia natalensis Walker.

1923. Ferrissia natalensis Walk., Ancylidae S.A., p. 74, pl. i, f. 21. D.F.

Shell pale greenish corneous, small, conical, much depressed, broad oval, slightly obovate, front and rear margins broadly rounded, left a trifle more curved than right, front slope nearly straight, rear very slightly concave, laterals straight, left a little the more oblique, apex about one-fourth length from rear, nearly on median line, only very slightly turned to right, subacute, with large central depression, radially striate, concentric sculpture fine and regular, radial fine and irregular. Long. 4·25, lat. 3, alt. 1·25 mm.

Hab. NATAL. South Coast Junction (type); Botanical Gardens, Durban (Cawston).

Type in coll. Walker.

Founded on three examples, and said to differ from its fellows in its depressed and broadly oval shell; a topotype and a young example from Durban are regularly oval, not obovate.

## Ferrissia zambesiensis (Walker). Ref. List No. 515.

1912. Ancylus zambesiensis Walk., Nautilus, xxv, p. 144. D.

1923. Ferrissia ,, ,, Ancylidae S.A., p. 75, pl. ii, f. 29. D.F.

Shell very small, pale greenish, subdepressed, short oval, ends broadly rounded, sides about equally curved, front and left slopes slightly convex, rear normally concave, right straight, apex about one-third of length from rear, on median line, very blunt, not beaked or perceptibly turned, strongly, closely, subrugosely radiate, concentric growth lines fine and regular.

Long. 2.25, lat. 1.6, alt. 0.75 mm.

Hab. S. RHODESIA. Victoria Falls (Connolly).

Type in coll. Walker.

While entirely interdistinct, this and the next species, so much vol. xxxIII. 34

alike in size and colour, are far smaller than others yet known from the subcontinent.

Ferrissia victoriensis (Walker).

Ref. List No. 514.

1912. Ancylus victoriensis Walk., Nautilus, xxv, p. 144. D.

1923. Ferrissia ,, ,, Ancylidae S.A., p. 75, pl. ii, f. 28. D.F.

Shell very small, pale greenish, subdepressed, elliptical, ends regularly rounded, right margin practically straight, left nearly so, front and left slopes convex, right and rear nearly straight, latter short and a little oblique, apex on median line, a little more than one-fourth length from rear, very blunt, not beaked or turned, very finely and closely radiate, later growth lines fine and regular.

Long. 2·25, lat. 1·5, alt. 0·75 mm. (The breadth of 1·8 mm. given by Walker in 1923 is a misprint.)

Hab. S. RHODESIA. Victoria Falls (Connolly).

Type in coll. Walker.

Ferrissia junodi Conn.

(Text-fig. 46.)

1925. Ferrissia junodi Conn., Trans. R. Soc. S. Africa, xii, p. 201. D.F.R.

Shell small, dark brown, conical, rather depressed, irregularly oval, narrowing to the rear, fore margin broadly, rear narrowly rounded, right nearly straight,



Text-fig. 46.—Ferrissia junodi Conn., Rikatla.
Teeth from radula; × 1200.

left much curved, front and left slopes moderately convex, right and rear very steep and nearly straight, apex less than one-fifth of length from rear, to right of median line, blunt, inclined to right, with very fine, close and shallow, scarcely rippled radial striolae, later concentric sculpture strong and regular, radial practically absent.

Long. 4·1, lat. 2·4, alt. 1·25 mm.

Hab. LORENZO MARQUES. Nwambukoti Pool, Rikatla (Junod).

Type in British Museum.

Radula formula  $(18+1+18) \times$  more than 90; central tooth with 2 main cusps, laterals about 8, each with an endocone, a mesocone, and from 2 to 3 small ectocones, marginals with several small cusps, the original mesocone the longest; transition from laterals to marginals gradual and ill defined.

## Ferrissia equeefensis (Walker). Ref. List No. 512.

1912. Ancylus equeefensis Walk., Nautilus, xxv, p. 143. D.

1923. Gundlachia equeefensis Walk., Ancylidae S.A., p. 79, pl. ii, f. 33. D.F.R.

1932. Kincairdilla (Gundlachia) equeefensis Walk., Cawst., S. Afr. J. Sci., xxix, p. 613. N.

Shell small, pale corneous, depressed, oval, ends about equally rounded, left margin only slightly more curved than right, front slope nearly straight except for slight curve towards apex, right and rear slightly concave, left slightly convex, apex about one-fourth or less of length from rear, very obtuse, turned to right, radial striolae shallow but rather coarse, later concentric sculpture fairly strong and regular, radial apparently lacking.

Long. 3.75, lat. 2.1, alt. 1.0 mm.

Hab. NATAL. Equeefa (type, Burnup).

Type in coll. Walker.

Radula formula approximately 17+1+17, central with 2 symmetrical main cusps and 2 minute ectocones, remaining teeth bearing 5 or more minute cusps, which resemble Walker's figure near the front of the radula where they are worn, but have the usual pointed form further back.

Walker transferred this species to Gundlachia because he believed that the characters of the radula showed that it belonged to that genus. But the details of these minute radulae are not easy to see, and Watson informs me that a careful study of specimens in the Gwatkin collection shows that Walker was mistaken and that the radula of this species is of the type found in Ferrissia, as briefly described above, whereas that of "Ancylus" tanganyicensis Smith, which Walker said was very similar, is really of a different type, more like that found in the genus Burnupia. Thus neither of these species should be placed in Gundlachia.

## Ferrissia farquhari (Walker).

1923. Gundlachia farquhari Walk., Ancylidae S.A., p. 78, pl. ii, f. 30-32. D.F.

Described from the septate form, in which the original shell is placed obliquely to median line of main shell, extending far beyond its right and a little beyond its hind margin; it is narrow, long oval, ends equally rounded and sides parallel, all slopes nearly straight, but sides a little curved towards apex, which is very blunt, situate well to the rear; front slope passes directly into that of the main shell, which is pale corneous, irregular oval, rather wider anteriorly, front margin broadly rounded, rear narrowly so, right nearly straight until curving towards the narrow hind end, left with greatest curve near front; fore slope, including that of septate portion, long, gentle and continuous, right and left a little oblique, latter slightly more so, peristome continuous, extending over the septum, aperture of septate portion small, oblique, forming rather more than a semicircle in front on a nearly straight, slightly oblique chord in rear.

Main shell: Long. 3·0, lat. 1·5, alt. 1·0 mm. Septate shell: Long. 1·5, lat. 0·75 mm.

Hab. CAPE PROVINCE. Brack Kloof River, 8 miles from Grahamstown (Farquhar).

Type in coll. Walker.

Founded on two examples, of which only one was mature.

### Ferrissia clifdeni nom. nov.

1925. Gundlachia resembling farquhari Walk., Cawst., Trans. R. Soc. S. Africa, xiii, p. 39, pl. iii, f. 1. N.F.R.

1925. Gundlachia burnupi Walk., Cawst., J. Trop. Med. Hyg., xxviii, p. 365, f. 4. R.

1926. Gundlachia burnupi Walk., Occ. Pap. Mus. Zool. Univ. Mich., No. 175, p. 1, pl., f. 1–5; pl. ii, f. 1–3. D.F.A.R.

Original shell pale corneous, much inclined to right rear and extending fully half its length beyond margin of main shell, long, narrow, ends evenly rounded, sides parallel, apex rounded, on right of middle and turned slightly to right, lateral slopes about equally curved, front slightly convex, passing directly into that of main shell, which is oval, ends equally rounded, sides little curved, front slope usually continuous with that of septate portion, but straightening towards front, laterals oblique, nearly straight, peristome continuous, apex radially striate, concentric sculpture medium to strong, radial fragmentary, aperture of septate portion somewhat to right centre of main shell, forming a rather oblique semicircle in front; underside of septum with strong regular growth lines, conforming to the oval contour of the margins.

Main shell: Long. 3·0, lat. 2·0, alt. 1·25 mm. Septate shell: Long. 1·75, lat. 0·75, alt. 0·5 mm.

Hab. NATAL. Umtwalumi, near Port Shepstone (type); Malvern (Cawston).

TRANSVAAL. Mooi R., Potchefstroom (Cawston).

Type in Natal Museum.

Radula formula 18+1+18, central symmetrical, with 2 major and 2 minor cusps, innermost laterals with 5, 7th with 6, 9th to 14th with about 8 cusps; the radula was described and figured by H. B. Baker, who stated that it had very little in common with that of typical Gundlachia. It differs little, however, from that of other species of Ferrissia.

As there is an earlier "Ferrissia burnupi" I must change the name of the present form, with the proviso that when more examples come to hand, it may prove to be conspecific with one of Walker's other species of this genus.

What may perhaps be the non-septate form of this species from Malvern is pale corneous brown, nearly oval, side margins nearly straight, diverging slightly forward, ends regularly rounded, front and side slopes nearly straight, rear straight and very short from base of apex, which is depressed, oboval, situate about one-fourth of length from rear, somewhat to right of median line and slightly turned to right, closely, finely microstriate, growth lines regular, fairly strong, with practically no radial sculpture.

Long. 3.75, lat. 2.25, alt. 0.75 mm.

Differs from all described species of African *Ferrissia* in its depressed apex and very short rear slope.

## Subfamily ANCYLINAE.

Shell patelliform, apex turned to the left; animal dextral; radula with lateral teeth trending backwards on each side; marginals horizontally disposed, but without cusps.

## Genus Ancylus Müll., 1774 (Verm. Hist., ii, p. 199)

(= Ancylus Geoffroy, 1767, non-binomial, Acroloxus Beck, 1837, and Velletia Gray, 1840).

Type Patella lacustris Lin., designated by Children in 1823.

The shell differs from all other genera of Ancylidae in having the apex turned to the left; otherwise very like that of *Ferrissia*.

I omit anatomical details, as it is doubtful whether the species described below will ultimately prove correctly assigned to this genus.

# Ancylus turtoni sp. n. (Pl. xvi, f. 16–18.)

1932. Ancylus sp., Turton, Marine Shells of Port Alfred, p. 159. L.

Shell very small, bleached white, moderately elevated, narrow suboval, ends regularly and about equally rounded, sides straight and parallel, front slope long, evenly convex, rear concave, extremely short, right more or less convex, a little more oblique than the left, which is nearly straight, apex about one-eighth or less of length from rear, nearly on median line, acute, strongly declined and beaked, nearly overhanging rear margin, distinctly turned to left, apparently without micropunctate or radial apical sculpture, later concentric fairly strong and regular, radial almost or entirely absent.

Long. 4.66, lat. 2.0, alt. 1.6 mm.

Hab. CAPE PROVINCE. Port Alfred (Turton).

Type in Albany Museum.

Nine specimens examined are all in bleached, much weathered condition, but all agree in showing fairly strong concentric, without a trace of apical or later radial sculpture, whereas another little shell from the same locality, in even worse condition, with dextral apex, shows plainly the strong apical punctation and later radiation of B. capensis. The smooth apex, therefore, together with its extreme posterior situation and sinistral, instead of dextral inclination, combine to mark turtoni generically distinct from other known African river limpets; for the present, however, rather than create a new subgenus until better material may be available, I place it in Ancylus, sensu lato, on account of the sinistral turn of its apex; it differs from the European lacustris in the smoothness and posterior position of this feature.

I have greatest pleasure in naming this remarkable novelty in honour of its discoverer, in particular recognition of his memorable work on "The Marine Shells of Port Alfred."

#### SUBCLASS STREPTONEURA.

Shell always present (except in a few marine forms) and usually operculate. Animal usually dioecious and generally characterised by the maximum torsion exhibited by the visceral mass and by the crossed visceral commissure. Pleural ganglia often united to opposite branch of visceral nerve. Head with only one pair of tentacles; heart almost always posterior to the gill.

#### ORDER Pectinibranchia.

Streptoneura with somewhat concentrated nervous system, usually with nerve collar situate behind buccal bulb. Osphradium single, independent and often pectinate. Heart with single auricle, not traversed by rectum; ctenidium, when present, single, usually monopectinate and attached to mantle throughout its length. Kidney single, usually opening directly by a slit-shaped aperture; gonad with separate orifice; male generally with penis.

#### Suborder Taenioglossa.

Radula with normally 3 teeth on each side of the central one. Stomato-gastric ganglia situate behind buccal mass, united to cerebral centres by long commissures; salivary ducts, when sufficiently long,

traversing nerve collar. Oesophagus nearly always devoid of unpaired gland.

#### TRIBE PLATYPODA.

Habit creeping; foot flattened ventrally; otocysts close to pedal nerve centre; jaw usually present; intestine long.

For conchological convenience I arrange the families in this group with those that live on land first, followed by those of aquatic habit, and the latter more or less in order of size, rather than in their strict anatomical sequence.

#### FAMILY CYCLOPHORIDAE.

Pallial cavity devoid of ctenidium and transformed into a lung; pedal centres in form of ganglionated cords; otocysts with otocones; aperture of shell and operculum circular, the latter usually multispiral; sole of foot simple, movement gliding as with pulmonate snails; tentacles rather long and tapering, with the eyes on short stalks at their bases; jaw present, radula long and narrow, central tooth with 3-7 cusps, others with 2-4 cusps each and trending obliquely backwards on each side. Habit terrestrial.

Genus *Maizania* Bgt., 1889 (Moll. de l'Afr. équat., p. 148). Type *M. olivacea* Bgt.

(= Aferulus Mts., 1897, Natalia G. Aust., 1897, Hijabia G. Aust., 1898, Austrocyclus Ancey, 1898, and Cyclophoropsis Dautz., 1908).

Shell corneous, of moderate size, depressed turbinate, umbilicate, without definite spiral sculpture, peristome simple; operculum thin, horny, single, multispiral, more or less concave externally, nucleus central.

Thiele considers this to be a subgenus of Ostodes Gld., a Polynesian genus, but related to the Neotropical Poterinae; it differs from the oriental genus Cyclophorus in its radula, as well as in its thin, simple peristome.

## Maizania wahlbergi (Bs.).

Ref. List No. 528.

1848.  $Cyclostoma\ translucidum\ Sow.,\ Krs.,\ Südafr.\ Moll.,\ p.\ 83.\ N.$ 

1852. Cyclostoma wahlbergi Bs., A.M.N.H., x, p. 271. D.

1854. ,, ,, ,, Pfr., Conch. Cab., p. 386, pl. 1, f. 17–19. D.F.

Shell of fair size, depressed turbinate, umbilicate, rather dull, silky, apex rose, remainder golden buff under a very thin deciduous brown periostracum. Spire little exserted, apex broadly rounded. Whorls 5, convex, rounded at periphery, rapidly increasing, first 2\frac{1}{4} practically smooth, remainder bearing very close, fine, regular, transverse striae, which are stronger before the periostracum is worn off; suture well defined. Aperture circular, peristome simple, acute, practically free, without reflexion, labrum nearly straight and vertical in profile, umbilicus deep and somewhat funicular.

Operculum corneous amber, thin, transparent, concentric, a little concave, with about 10 rib-like whorls and simple edge. The shell is usually coated with thick mud, which is difficult to remove without rubbing off the epidermis; hence most specimens in collections have lost that feature and are more glossy and brighter yellow than is characteristic of the species in natural condition.

Benson's type was little more than half-grown; the shell described above,

from Port St. Johns, measures

Diam. maj. 23·3, min. 19·0; alt. 18·8; apert. alt. 11·5, lat. 11·4 mm.

Hab. NATAL (type, Wahlberg per Stevens); generally in the bush fringing the coast (Burnup).

CAPE PROVINCE. Port St. John's (Power); Port Grosvenor (Bachmann).

Originals in Cambridge Museum.

Radula about 10 mm. long, with 100 rows of teeth, tricuspid except for the outermost, which are bicuspid; the admedian teeth have the outer posterior angles of their bases obliquely elongated.

Without further material and anatomical evidence there is no purpose in discussing the possible occurrence of this species under other names in Central Africa.

> Genus Chondrocyclus Ancey, 1898 (Bull. Mus. Marseille, i, p. 136). Type Cyclophorus convexiusculus Pfr.

Shell small, depressed, circular, widely umbilicate, pale corneous, covered with a deciduous hirsute periostracum; operculum duplex, formed by an interior base, smooth, glossy and nearly flat, and an exterior cup- or saucer-shaped portion, usually of from 4 to 6 whorls, edged by a cord-like rim, which terminates in a fringe, sometimes so strong as to render it impossible for the operculum to be withdrawn into the shell.

Chondrocyclus convexiusculus (Pfr.).

Ref. List No. 529.

1855. Cyclostoma (Cyclophorus) convexiusculus Pfr., P.Z.S., p. 104. D.

Cyclophorus plicicutis Bs., in litt.

1856. Cyclophorus convexiusculus Pfr., var. minor Bs., A.M.N.H., xii, p. 438. D.

1929. Chondrocyclus convexiusculus Pfr. (= var. minor Bs.), Conn., Ann. Natal Mus., vi, p. 238. N.R.

Shell small, depressed, circular, umbilicate, pale corneous, covered with a thick brown hirsute cuticle. Spire little exserted, each whorl just rising above the next, apex acutely mamillate. Whorls  $4\frac{1}{2}$ , convex, regularly increasing, the 2 apical colourless, smoothly punctate, remainder covered all over, on periostracum, with strong, slightly curved, transverse costae, developing at the periphery broad triangular flanges terminating in a hairy spine, the interstices between costae filled with about 6 fine, close, transverse microscopic striolae; suture impressed. Aperture nearly circular, peristome simple, continuous and free, labrum receding but little, umbilicus wide and deep, extending to the summit and exposing all the whorls. Operculum retractile, nearly flat, duplex, consisting of a polished base with a few spiral whorls, slightly concave beneath, on which is a smaller, extremely shallow saucer, with broad, thin nucleus and thickened rim, but usually so coated by an accretion of sandy mud that no whorls are discernible, while any fringe which may exist is very weak and quickly wears off.

Diam. maj. 5.2, min. 4.5; alt. 2.6; apert. alt. 1.6, lat. 1.9 mm.

Hab. CAPE PENINSULA. Simonstown (convexiusculus, Macgillivray); Table Mountain (var. minor, Layard); widely distributed over the peninsula.

CAPE PROVINCE. Montagu (Connolly); Riversdale; Palmiet R. Mountains, 2000 feet; Groot Vaders Bosch, Heidelberg, and probably Keurbooms R. bush (Barnard); Elim Road, 5 miles south of Bredasdorp (Rennie).

Type of convexiusculus in British Museum.

I proved in 1929 that Benson's var. minor is merely the type form of Pfeiffer's species, but that alabastris Crvn., which had been considered a synonym, has some claim to specific rank on account of its radula; it is, however, nearly impossible to distinguish one from the other unless the radula and operculum are available, so it is merely a surmise on my part that Pfeiffer's represents the western and Craven's the eastern race of these nearly allied forms, for which cause I have removed, tentatively, some of the localities in my Reference List from the former to the latter.

The radula averages about 87 rows of teeth, with 4 denticles on the second lateral, although the outer one is extremely small, but in *alabastris* there are only 3 on the tooth in question, a point which distinguishes it from the next two species, as well as from that now under consideration.

Chondrocyclus bathrolophodes Conn.

1929. Chondrocyclus bathrolophodes Conn., Ann. Natal Mus., vi, p. 239, pl. xiv, f. 30–34. D.F.R.

The shell comprises 4 whorls and differs from the last species in the nature of its periostracum, which is sharply keeled at the periphery and bluntly, though prominently so, round the umbilicus, the post-apical whorls sculptured all over with close, strong, regular, slightly curved transverse costae, which are a little farther apart on the last whorl and lamellate, instead of spiniferous, on each side of the suture and round the periphery, and also, to a less degree, on the basal keel. Aperture circular, peristome continuous, operculum duplex, bearing exteriorly a deep hollow cone, its apex resting on the rounded base, with 4–5 spiral whorls with cord-like border, terminating in a lamellar fringe, which is normally reflexed over the peristome and prevents the operculum being withdrawn into the shell.

Diam. maj. 6·1, min. 4·7; alt. 2·7; apert. diam. 2·25 mm.

One radula examined has 136 rows of teeth. On close examination extra denticles are found to occur sporadically in all the lines and not on the rhachidian only, as stated in the original description; the marginals thus bear sometimes 3 and sometimes 4 denticles on the main cusp.

Hab. CAPE PROVINCE. Kowie East (type, Kincaid); Port Alfred (Hewitt).

Type in British Museum.

Chondrocyclus trifimbriatus Conn.

1929. Chondrocyclus trifimbriatus Conn., Ann. Natal Mus., vi, p. 241, pl. xiv, f. 35–39. D.F.R.

The shell, with 4 whorls, differs from the last two as follows: the strong, close striae of the periostracum are prolonged into a lamellar fringe just above the periphery; a second, less conspicuous, at the periphery, and a third round the umbilicus; last whorl evolute just before the aperture, operculum duplex, exterior portion concave, forming about 5 spiral whorls with lirate edges, terminating in a rope-like fringe reflexed over the peristome.

Diam. maj. 4·4, min. 3·8; alt. 2·5; apert. diam. 1·5 mm.

One radula examined has 77 rows of teeth. The denticles on all the lines are smaller than in other species of the genus; a few extra denticles occur sporadically.

Hab. NATAL. Bush behind Karkloof Falls (Falcon).

Type in British Museum.

The striation is less prominent and operculum less cone-shaped than in *bathrolophodes*, while there is an additional fringe above the periphery.

 $Chondrocyclus\ putealis\ {\rm sp.n.}$ 

(Pl. xvi, f. 25-27.)

Although several examples, some alive, of this species have been available, none are sufficiently unweathered to show a perfect periostracum, so that my notes on

its sculpture are subject to the reservation that the costae may be found more highly developed into spines or lamellae and form ridges or fringes when better preserved specimens come to hand.

The 4 very convex whorls are well rounded with scarcely a trace of fringe at the periphery and none elsewhere; the last whorl descends strongly nearing the aperture, which is circular and entirely free, but there is practically nothing in the characters of the shell to distinguish it from part-worn examples of trifimbriatus. The type measures

Diam. maj. 4.7, min. 4.0; alt. 2.1; apert. ca. 1.6 mm.

The operculum has perpendicular sides like the wall of a well, not widely cupolaeform as in bathrolophodes and much taller than in trifimbriatus, and this well is less in diameter than the diaphanous base, and consequently retractile within the aperture, while its rope-like whorls coil steeply down the sides, leaving a clear nucleus on the base.

Three radulae examined resemble that of bathrolophodes rather than of trifimbriatus in having strong denticles on the laterals and in the more frequent occurrence of extra denticles on all the lines of teeth; the average number of rows exceeds 100, as compared with 136 in bathrolophodes and only 77 in trifimbriatus.

Hab. NATAL. Southport (type, Puzey). CAPE PROVINCE. Port St. John's (Falcon). Type in British Museum.

## Chondrocyclus alabastris (Crvn.). Ref. List No. 529 (pars).

1880. Cyclotus alabastris Crvn., P.Z.S., p. 619, pl. lvii, f. 9. D.F. 1929. Chondrocyclus alabastris Crvn., Conn., Ann. Natal Mus., vi, p. 238. N.R.

Founded on bleached, smooth, sand-blown examples devoid of periostracum or operculum; fresh shells from the same neighbourhood are practically indistinguishable from convexiusculus, but the exterior saucer of the operculum may be a little deeper than in the other, with 5 or 6 spiral whorls, and cord-like border, terminating in a weak, narrow, retractile fringe.

C. alabastris seems to attain greater size than convexiusculus, the type measuring 5.3 mm. in major diameter, while the largest available from Grahamstown is

Diam. maj. 7.6, min. 6.7; alt. 4.0; apert. alt. 2.3, lat. 2.2 mm.

The radula appears to be constant in there being only 3 denticles on the 2nd tooth instead of 4, as in the three foregoing species; there are about 86 rows of teeth and extra denticles are of rare occurrence.

Hab. CAPE PROVINCE. On sand-hills, Cape Récif, Algoa Bay (type, Craven); Port Elizabeth (Crawford); Grahamstown (Farquhar); Knysna (Mrs Longstaff) and probably Bedford (Farquhar); Katherg Forest; Port Alfred (Hewitt); Pirie Forest (Godfrey); George District; Tharfield (Layard).

Type in British Museum.

As already mentioned it is purely conjectural whether some of the eastern localities cited above are truly referable to this species.

## Chondrocyclus isipingoënsis (Stur.). Ref. List No. 531.

1898. ? Cyclotus isipingoënsis Stur., Anz. Akad. Wiss. Wien, xxxv, p. 161. D.

1898. Cyclophorus minimus M. & P., A.M.N.H., ii, p. 129, pl. vii, f. 9. D.F.

1899. Cyclophorus minimus M. & P., A.M.N.H., iv, pl. iii, f. 15. Operculum.

Shell very small, similar in form, colour and texture to convexiusculus, but entirely different in capillary process. There are 4 whorls, the last descending steeply nearing the aperture, first 2 smooth and colourless, while the costae on the remainder do not produce flanges, but 5 spiral lines of simple hairs at regular intervals, 1 around the periphery and 2 each above and below it. Operculum nearly flat, retractile, duplex, the shallow exterior saucer having a broad colourless nucleus and about 3 cord-like whorls, terminating in a thin, solid fringe, which can be withdrawn into the aperture.

Diam. maj. 3.0, min. 2.6 mm.

Hab. NATAL. Durban; Isipingo (isipingoënsis, Penther); Pietermaritzburg (minimus) and in bush generally, from the coast to Dargle and Karkloof (Burnup).

ZULULAND. Eshowe (Burnup); Mfongosi (Jones).

CAPE PROVINCE. Maeström Forest, Bedford (Farquhar).

Type of isipingoënsis in Vienna, minimus in British Museum.

There is half a whorl less in immature *convexiusculus* of equal size, which has, moreover, only the single peripheral row of hairs.

# Chondrocyclus exsertus M. & P. Ref. List No. 530.

1903. Chondrocyclus exsertus M. & P., A.M.N.H., xii, p. 608, pl. xxxii, f. 11. D.F.

Founded on semi-bleached examples, almost void of periostracum, but with higher spire than other known members of the genus. There are  $4\frac{1}{2}$  very convex whorls, the costulation being comparatively close and intermediate striolae consequently very fine; what appears to be an operculum, far within the aperture and too fragile for extraction, looks very thin, with broad nucleus. The type measures

Diam. maj. 4.2, min. 3.9; alt. 2.7; apert.  $1.5 \times 1.5$  mm.

Hab. NATAL. Umkomaas (type); Equeefa; Umbogintwini; Kelso Junction (Burnup).

Type in British Museum.

#### FAMILY POMATIIDAE

(= Cyclostomatidae).

Shell usually turbinate or ovate, aperture oval or circular: operculum calcareous, solid, usually paucispiral. Pallial cavity transformed into a lung, the gill being absent; pedal ganglia concentrated; otocysts each with a single otolith; foot-sole divided by a deep longitudinal groove into two halves which function alternately; tentacles cylindrical, with eyes on protuberances at their outer bases: no true jaw; radula with the last tooth on each side very broad and finely denticulate except on its outer part. Habit terrestrial, but not closely related to the last family, being probably more nearly allied to the marine Littorinidae.

> Genus Tropidophora Trosch., 1847 (Zeitschr. f. Mal., iv, p. 44). Type Cyclostoma cuvieriana Petit.

Subgenus Ligatella Mts., 1880 (Meeresfauna Mauritius, p. 186) (=Rochebrunia Bgt., 1881).Type Nerita ligata Müll.

Shell more or less globosely conoid, umbilicate, smooth or with spiral ridges, which are always present about the umbilicus; peristome simple, expanded or thickened; operculum paucispiral, usually coarsely striate, about 5 whorls, nucleus corneous, situate towards basal end.

For description of radula, etc. see under T. insularis on p. 547.

- A. Shell comparatively smooth and glossy, peripheral area without spiral ridges.
  - (i) Peristome simple, or slightly expanded.

Tropidophora ligata (Müll.). (Pl. xvii, f. 10.) Ref. List No. 538.

1774. Nerita ligata Müll., Verm., ii, p. 181. D. 1925. Tropidophora ligata Müll., Conn., Trans. R. Soc. S. Africa, xii, p. 206. L.

1925. Ligatella ligata Müll., Plry., Geog. Geol. Makalla, App. II, p. 230, pl. xxxv, f. 16.  $\,N.F.$ 

1927. Tropidophora ligata Müll., Cawst., Observation, p. 16. R.

Shell of good size, turbinate globose, umbilicate, solid, calcareous, nearly smooth, rather glossy, buff or whitish, rarely orange, usually with a rather broad brown band around the periphery and frequently a varying number of narrow bands, rarely coalescent, above it. Spire somewhat exserted, sides regular, apex bluntly rounded. Whorls 5, convex, rounded at periphery, regularly increasing, protoconch, 1½ whorls, practically smooth, sculpture on remainder, very weak at first, consisting of close, fine, regular, straight, nearly vertical striae, and from 3 to 5 strong narrow spiral ridges just below the suture and a number of far weaker ones between them and extreme base, where there are 4 or 5 more, extremely strong; suture simple, impressed. Aperture nearly circular, peristome continuous, but not free, straight and nearly vertical in profile, slightly thickened and expanded, white and glossy, umbilicus narrow, but deep.

Operculum calcareous, slightly concave, 5 whorls, sculptured with strong, feather-like striae of irregular shape.

Alt. 19·7, diam. maj. 16·8, min. 15·2; apert. alt. (intern.) 8·5, lat. 7·8; last whorl 15·4 mm.

Hab. CAPE PENINSULA (probable type locality); generally distributed; Simons Bay; Buffelsfontein, Cape Point, etc.

CAPE PROVINCE. Generally distributed along and near the coast east of Cape Town.

GRIQUALAND WEST. Bees Hoek, Postmasburg (Mrs. Tredrea). NATAL. Coast and Midlands generally (Burnup).

ZULULAND. Hluhluwe District (Bell Marley).

TRANSVAAL. Lydenburg; Barberton (fide Sturany); Doornkop, Belfast (orange var., Hewitt).

LORENZO MARQUES. Zangwe Basin (Cressy); Tette (Peters); Delagoa Bay (Barnard); Wanetsi River (Bell Marley); Rikatla (Junod).

Original in Copenhagen Museum.

This species is extremely variable in coloration and ratio of altitude to diameter, while the spiral sculpture, both basal and subsutural, varies greatly in strength, though the latter is never nearly as strong as in the lirate group; some normally high shells from Port Elizabeth measure  $20 \times 18$  and  $17.5 \times 15.2$ , and a low pair from Uisidorn, Natal,  $16.6 \times 18$  and  $16.8 \times 17.1$  mm. in height and breadth; the largest I have seen, from Buffelsfontein, are  $22 \times 20.2$  and  $21 \times 19$  mm.

The Zulu shells have a very slightly, but distinctly expanded peristome; the animals are uniform reddish grey, without banding, and the bilobed snout remarkably long; they were picked off the trunks of *Mimosa* bushes.

Were it not that they have already received varietal names, so

greatly beloved by the acquisitive school of collectors, there would be no object in retaining the two forms which follow, since both occur in company with typical examples, without any line of demarcation.

## var. caffra Rve.

Ref. List No. 538 (pars).

1837. Cyclostoma cafreria Beck, in Cat. Coll. Férussac, p. 15. L. 1861. caffrum Beck, Rve., Conch. Icon., pl. xi, f. 67. D.F.

Merely a white form of *ligata*.

Hab. CAPE OF GOOD HOPE (Ecklon); frequent in company with the banded forms of ligata.

Originals in British Museum.

## var. affinis Sow.

Ref. List No. 538 (pars).

1828. Turbo ligatus Wood, Index Test., p. 151, pl. xxxii, f. 122. F.

1847. Cyclostoma affine (= Turbo ligatus Wood), Sow., Thesaurus, i, p. 98, pl. xxiii, f. 25-26. D.F.

1848. Cyclostoma affine Sow., Pfr., Conch. Cab., p. 62, pl. viii (1847), f. 17–18. D.F.

1848. Cyclostoma affine Sow., Krs., Südafr. Moll., p. 82. N.

1852. Cyclostomus ligatus Müll., var. minor (=affine Sow.), Pfr., Mon. Pneum., i, p. 222. N.

Applied to the smaller examples of ligata, Pfeiffer giving the dimensions as: axis 13, diam.  $15 \times 12$  mm.

Hab. Frequent in company with and grading into the normal form.

## Tropidophora hartvigiana (Pfr.).

(Pl. xvii, f. 7.)

#### Ref. List No. 535.

1862. Cyclostomus hartvigianus Pfr., Mal. Blätt., ix, p. 203. D. " Novit. Conch., ii, p. 225, pl. 1863. lix, f. 1-2. D.F.

Perhaps only another colour variety of ligata, usually white but occasionally banded, and remarkable for the beautiful red or orange hue of its interior, vivid near the lip and gradually fading inwards. A paratype in British Museum

Alt. 19.0, diam. 15.5; apert. alt. 10.0, lat. 8.5; last whorl 15.0 mm.

Hab. "SOUTH AFRICA" (type, Hartvig).

CAPE PROVINCE. Limestone Quarry, Bredasdorp (Rennie).

Originals in British Museum.

Rennie's rediscovery of this uncommon form confirms the unusual apertural coloration stressed in Pfeiffer's description and suggests that it is localised in this district of the province, which is that in which Hartvig carried out most of his collecting.

Tropidophora comburens M. & P.

Ref. List No. 534.

1903. Tropidophora comburens M. & P., A.M.N.H., xii, p. 608, pl. xxxii, f. 12. D.F.

A smooth and rather small form differing from ligata in its contour being narrower throughout and the narrow umbilicus half concealed by the expansion of the columellar margin; the circumbasal lirae are very strong. The colour scheme of the type set consists of a buff ground with a single, rather narrow peripheral dark red band, on each side of which is a broader one of paler hue, which is apt to become split into two; 5 convex whorls, two average examples measuring  $11 \times 10$  and  $13 \times 11$  mm. in height and width respectively.

Hab. ZULULAND. Makowe (type Burnup); Hluhluwe Reserve (Rump); False Bay (Bell Marley).

Type in British Museum.

Tropidophora foveolata (M. & P.).

(Pl. xvii, f. 9.)

Ref. List No. 534.

1895. Cyclostoma foveolatum M. & P., A.M.N.H., xv, p. 164, pl. xii, f. 4. D.F.

Differs prominently from others of the group in being pitted, especially on the last 2 whorls, with fairly regular spiral lines of close, small, punctate dots, which are as strong between the umbilical sulcae as elsewhere on the surface. There are 5 whorls, sometimes unicoloured, but usually greyish white with 1 or 2 broad and occasional narrow brown bands. A mature example from Port Alfred with slightly expanded peristome measures

Alt. 17.8, diam. maj. 16.9, min. 13.3; apert. alt. 9.5, lat. 8.2; last whorl 14.4 mm.

Hab. SOUTH AFRICA (type, fide M. & P.).

CAPE PROVINCE. Port St. John's (Power); Port Alfred (Farquhar); Knysna (O'Connor).

Type in British Museum.

Traces of the same pitting are sometimes visible in *ligata*, but never to nearly the same extent as always occurs in the present species.

## Tropidophora anceps (Mts.).

1878. Cyclostoma anceps Mts., Monatsb. Akad. Wiss. Berlin, p. 288, pl. i, f. 4. D.F.

1890. Cyclostoma anceps Mts., Smith, A.M.N.H., vi, p. 148. N.

1891. ,, ,, Sitz.-Ber. Ges. Nat. Fr. Berlin, p. 14. N.

1895. Cyclostoma anceps Mts., Ann. Mus. Genova, xxxv, p. 63. N. 1897. , , , D.O.A., iv, p. 3. N.

1916. Tropidophora anceps Mts., Germ., Bull. Mus. Paris, xxii, pp. 161, 259. N.

1918. Tropidophora anceps Mts., Germ., ibid., xxiv, p. 370. N.

1925. ,, ,, ,, Conn., Trans. R. Soc. S. Africa, xii, p. 202. N.

Apparently the northern form of ligata, from which it differs typically in larger size, while the 6 or 7 subsutural spiral sulcae are exceptionally strong, but it is not always easy to differentiate smaller examples from Müller's variable species. The coloration is unusually constant, a single peripheral brown band on cream ground, with orange apex, while Germain has described a var. bicincta in which there is an upper band, sometimes of paler hue. A typical example from Voi, Kenya Colony, with 6 whorls, measures

Alt. 27, diam. maj. 24·2, min. 20·3; apert. alt. 14·5, lat. 12·2; last whorl 21·6 mm., while the Andrada shells, which are quite typical in sculpture and coloration, measure

Alt. 20.5, diam. maj. 21.0, apert. alt. 12, lat. 11 mm.

Hab. LORENZO MARQUES. Andrada (Vasse).

Type in Berlin Museum.

Described from Taita, Kenya Colony, and recorded from many localities from Italian Somaliland down to Tanganyika Territory and the Belgian Congo.

# (ii) Peristome white, glossy, expanded, and reflexed.

# Tropidophora delmaresi (Bgt.).

1887. Rochebrunia delmaresi Ancey, Bgt., Bull. Soc. Mal. Fr., iv, p. 269. D.

1889. Rochebrunia delmaresi Ancey, Bgt., Moll. Afr. Équat., p. 146. N.

1890. Cyclostoma delmaresi Bgt., Smith, A.M.N.H., vi, p. 148. L., and note on unidentified species.

1897. Cyclostoma delmaresi Ancey, Mts., D.O.A., iv, p. 6, pl. ii, f. 2. N.F.

1914. Otopoma (Rochebrunia) delmaresi Ancey, Kob., Conch. Cab., p. 1029, pl. cli, f. 8. D.F.

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The shell which I ascribe to this species differs from all the foregoing in its thick, white, glossy, expanded and slightly reflexed peristome. The first 2 whorls are smooth, 3rd and 4th bearing a few fine, low, regular, spiral lines (7 on 4th whorl), which are weaker on the last and absent below periphery until the umbilical region, where are visible 5 strong, white, glossy ridges; transverse sculpture very fine and close, crossing the spiral. 5 convex whorls, first 4 bright orange, last bluish white, so thickly covered with weak bands of purple-brown that the ground colour is hardly visible; peristome continuous, umbilicus very narrow.

Alt. 16.5, diam. maj. 15.3, min. 12.0; apert. alt. 10.0, lat. 8.8; last whorl 9.1 mm.

Hab. CAPE PROVINCE. East London (Puzey). Described from Tanganyika Territory, where it has a wide range. Type ubi?

- B. With fairly strong spiral sculpture including peripheral area.
  - (i) Peristome more or less expanded.

Tropidophora insularis (Pfr.). (Pl. xvii, f. 4–5.) Ref. List No. 536.

1852. Cyclostoma insulare, Pfr., P.Z.S., p. 64. D.

1922. Tropidophora insulare Pfr., Conn., Proc. Mal. Soc., xv, p. 77. L.

1925. Tropidophora insularis Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 203, pl. vi, f. 5–9. A.R.

Shell of fair size, globose conical, narrowly umbilicate, fairly solid, dull, asperate, buff, yellow, or rose, with or without a varying number of dark bands that vary in breadth. Sides straight, apex minutely rounded. Whorls  $5\frac{1}{2}$ , convex, regularly increasing, first  $2\frac{1}{4}$  smooth and glossy, remainder sculptured all over with close, strong spiral ridges of varying prominence, the interstices filled with very close, slightly oblique transverse costulae; suture deep, subcrenulate. Aperture nearly circular, peristome slightly expanded, not quite continuous, labrum straight and only receding a little in profile, umbilicus very narrow but deep. One of the type set measures

Alt. 20·0, diam. maj. 17·5, min.  $14\cdot0$ ; apert. alt.  $11\cdot4$ , lat.  $10\cdot0$ ; last whorl  $16\cdot3$  mm.

Hab. NATAL. Generally distributed about the coast and midlands. ZULULAND. Mfongosi (Jones).

TRANSVAAL. Shiluwane District (Junod).

CAPE PROVINCE. Alexandria District (Crawford); Port St. John's (Puzey); Pirie (Godfrey); East London (Rattray).

GRIQUALAND WEST. Modder River, near Kimberley (Miss Wilman).

S. RHODESIA. Mt. Silinda, Melsetta (Miss A. de Klerk).

LORENZO MARQUES. District north of Macequece (Cressy). Type in British Museum.

Described from a set in the Cuming collection labelled "Mauritius," a locality which Pfeiffer amended to "Natal" in his own working copy of his Monograph. If all the localities attributed to this species are truly referable thereto, it is indeed a variable one, both in size and sculpture, but the presence of almost every intermediate grade forbids me to differentiate the extremes; Rattray's set from East London is uniform dark rose, as is one of the type set, while the pretty all yellow variety sometimes occurs among banded examples; the apex is usually, but not invariably, orange red. The series from Port St. John's (f. 5), typical in form and sculpture, are for the most part uniform cream with the first 2 or 3 whorls bright rose; while fully mature, with strongly expanded and slightly reflexed peristome, they are far below normal size, the figured specimen measuring

Alt. 11.0, diam. maj. 9.4, min. 7.9; apert. alt. 6.0, lat. 5.2; last whorl 9.0 mm.

As might be expected from the foregoing remarks, the animal varies; in Macequece specimens it is buff in colour, with yellow tentacles, the conspicuous black eyes situate on slight prominences at the outer bases; muzzle rather long, crossed by transverse grooves, except in centre of lower surface, where a pair of longitudinal grooves occurs; sides of animal covered by a fine network of grooves, sole cleft longitudinally, and as the animal moves the two halves are used alternately, the end of the muzzle being also applied to the ground at frequent intervals. The radula of a Macequece example is about  $6\frac{3}{4}$  mm. long and has 230 rows of teeth; the centrals are usually furnished with 5 short cusps, though some have 6, one of the small outer cusps being divided into two; the first laterals have 5 or 6 cusps, second laterals usually 6 or 7 rather narrower ones, some as many as 8; marginals much broader, divisible into three portions; an inner division with 6-9 small cusps or denticles, a middle division with about 18-20 narrow denticles, like the teeth of a comb, and an outer more delicate portion, without dentition. In Natal specimens the animal is paler, the radula is slightly smaller and the denticles on middle division of marignal teeth rather broader and less numerous, average number about 11 or 12, which suggests that the Macequece form may perhaps prove to be a distinct species.

Tropidophora sarcodes (Pfr.). (Pl. xvii, f. 3.)

Ref. List No. 542.

1856. Cyclostoma sarcodes Pfr., P.Z.S., p. 339. D.

The sculpture is of similar pattern to *insularis*, but far weaker, except in the umbilical region; ground colour usually buff, with at least one strong peripheral dark brown band, which usually extends to the *outer* margin of the white, reflexed labrum; peristome usually continuous. The type contains 5 whorls and measures Alt. 18·3, diam. maj. 15·5, min. 12·7; apert. alt. 9·5, lat. 8·4; last whorl 14·0 mm.

Hab. CAPE PROVINCE. Knysna (Cox; O'Connor); Kwelegha Mouth (Power); Qolora; Kei R. mouth (Swan).

Type in British Museum.

Described as from Madagascar, but the type pair agrees entirely with the Knysna race, and probably hails from that locality.

Tropidophora calcarea (Sow.).

(Pl. xvii, f. 11.)

Ref. List No. 532.

1822. Cyclostoma sulcata Lam., Hist. Nat. An. s. Vert., vi, 2, p. 144. D.

1847. Cyclostoma calcareum (= sulcata Lam., 1822, non Drap., 1805) Sow., Thesaurus, i, p. 118, pl. xxvi, f. 113. D.F.

1848. Cyclostoma calcareum Sow., Pfr., Conch. Cab., p. 88, pl. xi (1847), f. 11-12. D.F.

1925. Tropidophora (Ligatella) calcarea Sow., Conn., Trans. R. Soc. S. Africa, xii, p. 203. N.

A large species, with extremely strong spiral and very weak transverse sculpture, there being about 21 coarse sharp ridges countable from within the umbilicus to the suture on the last whorl, with 6 or 7 weaker ones in the intervals above the periphery; colour whitish, sometimes with dark peripheral band; peristome thickly expanded, umbilicus very narrow. The shell figured, from Zanzibar, contains 5½ whorls and measures

Alt. 22·5, diam. maj. 22·3, min. 16·6; apert. alt. 13·0, lat. 11·5; last whorl 18·8 mm.

Hab. LORENZO MARQUES. Tette (Kirk; Thomson).

Originals of calcarea in British Museum.

Easily recognisable by its strong spiral costulation, and apparently confined to the Zanzibar district and a few localities near the east coast in Tanganvika and Portuguese East Africa.

Tropidophora plurilirata Fulton.

(Pl. xvii, f. 8.)

Ref. List No. 541.

1903. Tropidophora plurilirata Fult., J. of Mal., x, p. 103, pl. ix, f. 8. D.F.

Differs from rest of group in the extreme fineness and closeness of the spiral ridges, of which there are usually at least 40 on the last whorl. Buff or white, usually with a single narrow peripheral brown band, peristome very narrowly expanded, umbilicus very narrow. A typical example with 5 very convex whorls

Alt. 15.6, diam. maj. 14.1, min. 12.3; apert. alt. 8.4, lat. 7.7; last whorl 13.0 mm.

Hab. CAPE PROVINCE. Grahamstown (type, Miss Leppan; Farquhar).

NATAL. Pinetown; Pietermaritzburg (Burnup).

ZULULAND. Mfongosi (Jones); Mganduli (J. C. Trow); St. Lucia; Mkuzi; near Mazimba Hill; Umfolosi Game Reserve (Haas). Type in British Museum.

> Tropidophora lineata (Pfr.). (Pl. xvii, f. 2.)

> > Ref. List No. 539.

1852. Cyclostoma lineatum Pfr., P.Z.S., p. 65. D.

1854. " Conch. Cab., p. 350, pl. xlv, f. 3-4. D.F.

Transverse sculpture extremely weak, spiral, at least above periphery, arranged as in kraussiana in regular fine ridges, alternately weak and strong, about 30 in all on last whorl, while in the type, on a buff ground, each of these are coloured pale and bright chestnut respectively into the umbilicus, all showing clearly within the shell, with a broader zone at periphery; peristome continuous, very slightly thickened in maturity, umbilicus narrow. The type, with 5 convex whorls, measures

Alt. 15.3, diam. maj. 14.8, min. 12.4; apert. alt. 8.0, lat. 6.9; last whorl 11.5 mm.

Hab. NATAL (coll. Cuming in British Museum).

Type in British Museum.

The type is said to hail from Madagascar, and I cannot quite match it, or the set ascribed to "Natal," with any African shells.

Tropidophora kraussiana (Pfr.).

(Pl. xvii, f. 1.)

Ref. List No. 537.

1852. Cyclostoma (Tropidophora) kraussianum Pfr., P.Z.S., p. 64.  $D_{\cdot}$ 

1925. Tropidophora (Ligatella) kraussiana Pfr., Conn., Trans. R. Soc. S. Africa, xii, p. 206. N.

1933. Tropidophora kraussiana Pfr., Pilsb. & Ckll., P.Z.S., p. 365. L.

Rests on the type alone, wherein Pfeiffer emphasises that the shell is sculptured with very numerous keel-like raised ridges, which are stronger and smaller alternately, and that the last whorl is distinctly keeled on the periphery. This, however, is not the case, being simply due to one of the stronger ridges occurring at this point, suggesting the appearance of a keel. The alternate weak and strong ridges are as mentioned above the periphery, but somewhat intermittent below it, there being 7 of each above, but 16 strong and only 8 weak below, as far as can be counted into the umbilicus, from which the latter are absent, but this alternation can be found, though to a less extent, in many individuals of insularis. The body whorl is somewhat flattened and aperture thrown out to the right, with wider and more open umbilicus than usual, all which features might be attributable to accidental abnormality, though there is no early fracture in the shell to substantiate this theory. The semi-bleached type is dirty white with a single faded peripheral band, contains 5 convex whorls, and measures, allowing a trifle for broken apex,

Alt. 13.9, diam. maj. 13.7, min. 11.0; apert. alt. 7.1, lat. 6.9; last whorl 10.4 mm.

Hab. NATAL. Cape Natal (type, coll. Cuming); Durban Bluff (Miss A. Mackie, fide Pilsbry & Cockrell).

TRANSVAAL. Pilgrims Rest (fide Craven).

LORENZO MARQUES. Inhambane (fide Gibbons).

CAPE PROVINCE. Port Elizabeth (fide Morelet); Pondoland (Beyrich) and Port Grosvenor (Bachmann, fide Martens).

Type in British Museum.

Neither Burnup, Ponsonby-Fane, nor myself have ever been able to match the type, which appears abnormal, and it is improbable that any except the first of above records is correct.

# Tropidophora nyasana (Smith). (Pl. xvii, f. 12.)

1899. Pomatias nyasanus Smith, P.Z.S., p. 591, pl. xxxv, f. 5. D.F. (pessime).

1906. Ligatella nyassana Smith, Ancey, Bull. Sci. Fr. Belg., xl, p. 261. L.

1907. Pomatias nyasanus Smith, Melv. & Standen, Man. Memoirs, li, 4, p. 4. N.L.

1925. Tropidophora (Ligatella) nyasana Smith, Conn., Trans. R. Soc. S. Africa, xii, p. 206. L.

Very near *insularis*, from which it may possibly differ in the narrow umbilieus not being overhung by the columellar margin and the spiral ridges being extremely regular in strength and spacing over the entire surface, about 31 on last whorl of

type and scarcely, if at all, stronger in umbilicus. Coloration very constant, a pale buff ground with single peripheral purple band, though rare examples have two or none. The type contains 5 convex whorls, with minutely thickened peristome, and measures

Alt. 19.4, diam. maj. 20.3, min. 16.7; apert. alt. 10.8, lat. 9.2; last whorl

16.0 mm.

Hab. LORENZO MARQUES. Mtisherra R. Valley (Cressy): frontier south of Dedza (Mrs. Connolly).

S. RHODESIA. Mt. Silinda (J. H. Sandground).

Type in British Museum.

Described from Nyasaland and fairly frequent there and in Northern Rhodesia and recorded by Ancey from the Belgian Congo; Smith's figure depicts a more depressed shell than the actual type, though the colour scheme is correctly portrayed. The series from Mtisherra R. Valley trend in sculpture towards insularis and I would hesitate to differentiate nyasana therefrom, were it not that Smith's species is published, and recognisable by its coloration when collected within the limits of its probable distribution, and that its anatomy may prove it eventually worthy of retaining its status.

(ii) Peristome not expanded, scarcely thickened.

Tropidophora transvaalensis (M. & P.).

(Pl. xvii, f. 6.)

Ref. List No. 543.

1891. Cyclostoma transvaalense M. & P., A.M.N.H., viii, p. 237. D.

A small form with 16 or 17 strong but fine spiral ridges on the last whorl and far finer, closer transverse sculpture than insularis; although unicoloured white, yellow, orange and roseate examples are known, the colour scheme is nearly always a single narrow reddish peripheral band on pale buff or orange ground; peristome usually continuous, umbilicus comparatively less narrow than in most of group B., and the 6-8 ridges in umbilical region very strong. A topotype with 4 very convex whorls measures

Alt. 13.3, diam. maj. 13.0, min. 10.1; apert. alt. 6.8, lat. 6.1; last whorl 11.0 mm.

Hab. TRANSVAAL. Pretoria (type, Farquhar; Connolly); Pietpotgietersrust (Connolly); Letaba Camp, Krüger Park (Haas).

CAPE PROVINCE. Adelaide (Farquhar).

Apparently the Transvaal form of insularis, from which it may differ in generally smaller size and finer transverse sculpture.

Tropidophora ochracea (M. & P.). Ref. List No. 540.

1896. Cyclostoma ochraceum M. & P., A.M.N.H., xviii, p. 318, pl. xvi, f. 8-9. D.F.

Slightly larger and comparatively flatter than the foregoing, with strong spiral ridges, the interstices very finely obliquely striate; umbilicus narrow but deep. The single known example is uniform brownish orange, with 5 convex whorls, and measures  $13.5 \times 15$  mm. in altitude and diameter. I have not been able to examine it recently, but conclude from the original description that the peristome is not expanded.

Hab. SOUTH AFRICA (fide M. & P.). Type in British Museum.

#### FAMILY PILIDAE

(= Ampullariidae).

Shell medium to very large, dextral or sinistral, operculum concentric with submedian nucleus near columellar margin. Animal dextral, head with long tapering tentacles and eyes on stalks at their outer bases, muzzle terminating in 2 long tapering labial processes, anterior edge of foot doubled. Epipodial lobes forming left (inhalent) and right (exhalent) conduits; penis arising from right side of mantle edge; mantle-cavity containing a monopectinate gill adnate throughout, divided by a perforated partition attached to mantle and segregating an upper left chamber which functions as a lung. Cerebral ganglia united by an anterior labial commissure; pedal centres in form of ganglionated cords; otocysts with many otoconia. Central tooth of radula more wide than long, laterals with long rhomboidal body and about 4 cusps of which the 2nd is the largest, marginals with 2 or rarely 3 cusps. Amphibious forms, living in fresh water.

Genus Pila Röding, 1798 (Mus. Boltenianum, p. 145). Type Helix ampullacea Lin. (= Ampullaria Lam., 1799).

Shell large to medium, dextral, globular or ovate, usually umbilicate, brown or green, often with darker bands, more visible inside than outside the shell; weak vertical and often scarcely visible microspiral sculpture; operculum rigid, with strong calcareous layer inside.

Only two species are yet known from South Africa, both of which are fortunately very easily recognisable.

1851. *Ampullaria wernei* (=rugosa Parr. in litt.) Phil., Conch. Cab., p. 19, pl. v, f. 4; pl. xvii (1852), f. 2. D.F.

1910. Ampullaria wernei Phil., Sow., Proc. Mal. Soc., ix, p. 62.  $\boldsymbol{L}$ .

1925. Ampullaria wernei Phil., Alderson, Studies in Ampullaria, p. 89, pl. xviii, f. 2, 5, 6. D.F.

1930. *Pila wernei* Phil., Conn., Ann. S.A. Mus., xxix, p. 319. *N.L.* Only references of importance or local interest are given above.

One of the largest African species, narrowly umbilicate, whorls somewhat gradate, flattened, though not channelled at suture, but the most prominent distinguishing feature, when present, is that the surface is strongly malleate in spiral lines of short grooves or large round punctures. The typical coloration is olive-green or -brown, sometimes yellowing below the suture and towards the aperture, with a large number of narrow dark bands, which show plainly within the shell; interior usually dark brown. In all of Alderson's figures and examined Ovambo shells the labrum leaves the suture at nearly a right angle before curving down and round the rather narrow base; it is straight and erect in profile; columella erect, margin not much expanded. An Ovambo example of average size with 4½ whorls measures

Alt. 57, lat. 53; apert. alt. 48, lat. 27; last whorl 52 mm., Shortridge's largest example being  $62\times56$  mm.

Hab. OVAMBOLAND. Okovango River (Wohlfahrt); upper reaches of Omuramba-Omataka River (Shortridge).

Type probably in Santiago Museum.

Described from the Sudan and recorded from Uganda, Zanzibar, Mozambique, Belgian Congo, Nigeria, Ubangui and Abyssinia.

# Pila occidentalis (Mouss.).

Ref. List No. 544.

1887. Ampullaria occidentalis Mouss., J. de C., xxxv, p. 299, pl. xii, f. 9. D.F.

1910. Ampullaria occidentalis Mouss., Sow., Proc. Mal. Soc., ix, p. 60. L.

1919. Ampullaria occidentalis Mouss:, Germ., Bull. Mus. Paris, p. 48. D.N.

1925. Ampullaria occidentalis Mouss., Alderson, Studies in Ampullaria, p. 85, pl. xvii, f. 5–7. N.F.

1929. Pila occidentalis Mouss., Adens., Ann. Nat. H. Mus. Wien, xliii, p. 397, pl. xiii, f. 5. N.F.

1930. Pila occidentalis Mouss., Conn., Ann. S.A. Mus., xxix, p. 318. L.

Far smaller than the foregoing, remarkable for its dull, thin texture, semi-transparent shell and pale green colour, with or without a varying number of narrow chestnut bands; interior nearly white. A typical example figured by Alderson with  $4\frac{1}{2}$  whorls measures

Alt. 40·0, lat. 36·0; apert. alt. 28·0, lat. 19·3; last whorl 35·3 mm.

Hab. OVAMBOLAND. Kunene River (type, Geale; Schintz); below Erikson Drift (Lebzelter); Ondongua (Barnard).

DAMARALAND. Nuragas (Lightfoot); Okosongoho (Hermann). BRITISH BECHUANALAND. Nausche, or Nausib, River; Okavango marshes; Lake Ngami; Botletle District (Passarge).

Also recorded from Angola.

Type in Zurich Museum.

Genus Lanistes Montf., 1810 (Conch. Syst., ii, p. 122).

Type L. olivieri Montf. (Cyclostoma carinata Oliv.).

Shell sinistral, medium to large, umbilicate; peristome simple; operculum thin, corneous, its nucleus near inner margin. Animal dextrally organised.

Subgenus Meladomus Swains., 1840 (Treatise on Malac., p. 340).

Type M. bulimoides Swains. (Ampullaria olivacea Sow.).

Shell ovate to turbinate, rounded at periphery, smooth, solid, unicoloured dark green or brown, spire more or less exserted, umbilicus narrow.

Only three members of this genus are known to occur south of the Zambesi and they remain of average, comparatively small size, none attaining the enormous dimensions to which they are liable north of our limits, and which have earned for various races numerous varietal and doubtfully valid specific names. For the above reason I refrain from entering into the difficult question of synonymy and confine references and descriptions to those easily recognisable forms which actually inhabit South Africa. Some species are peculiarly liable to extremely strong, coarse rugation of the epidermis in the lines of growth, especially on the last whorl, both Martens and Germain having considered such to be of varietal, and even specific importance. It is, however, purely an individual idiosyncrasy, of occasional occurrence, usually on somewhat senile specimens, in colonies of perfectly normal examples, and cannot be regarded as more than a slight abnormality; I have not noticed its presence on South African

specimens, but have done so in both ovum and olivaceus from more northern latitudes.

Lanistes ovum Trosch.

(Pl. xvii, f. 13.)

Ref. List No. 547.

1845. Lanistes ovum Peters, Trosch., Arch. f. Naturg., xi, 1, p. 215. D.

1916. Lanistes ovum Peters (=affinis Smith (cum var. manayarana Stur.), ellipticus Pfr. (cum var. luapulensis and var. trapeziformis Furt.), ambiguus and deguerryanus Bgt., zambezianus Furt. and var. elatior Pfr.), Sow., Proc. Mal. Soc., xii, p. 67. Synonymy.

1919. Lanistes ovum Ptrs., Germ., Bull. Mus. Paris, p. 50. D.

1920. " " " " Voy. Babault, p. 235. D.F.

1925. ,, ,, ,, Conn., Trans. R. Soc. S. Africa, xii, p. 207. L.

1927. Lanistes (Meladomus) ovum Ptrs., P. & B., Bull. Amer. Mus. N.H., liii, p. 196. N.

1936. Lanistes (Meladomus) ovum Peters, Haas, Abh. Senckenb. Ges., No. 431, p. 34. N. Synonymy.

Shell large, ovate, umbilicate, smooth, glossy, olive-green or brown, without banding, but frequently a narrow line of bright orange immediately below the suture, columella rosy or bluish white, interior brown. Spire moderately exserted, apex bluntly rounded. Whorls  $4\frac{1}{2}$  to 5, convex, rapidly increasing, 1st smooth, remainder bearing close, regular, vertical striae, crossed by fairly close, fine, regular, interrupted microspiral lines; suture simple. Aperture subovate, labrum straight and erect in profile, columella slightly concave and inclined to the left, margin moderately reflexed, little obscuring the narrow umbilicus, round which there is practically no trace of carination. The example figured, from Lake Pavi, is of average size and measures

Alt. 41, lat. 35; apert. alt. 25, lat. 20; last whorl 34 mm.

Operculum very thin, concentric striation extremely close and fine.

Hab. LORENZO MARQUES. Tette (type, Peters); Itschongove, Delagoa Bay (Schenck); L. Pavi; Inhambane; L. Mhandlen; Rikatla (Junod); Wanetsi R., Majude Dist. (Bell Marley); Beira (Cawston); Mtisherra R. Valley (Cressy).

ZULULAND. R. Pongola (Bell Marley).

TRANSVAAL. "Libonibo" (Lebombo?, Wilms, fide Mts.).

BRITISH BECHUANALAND. Ngami River (Passarge, fide Mts.); Maun (Hale Carpenter).

S. RHODESIA. Meno's Kraal (Penther, fide Sturany).

Type in Berlin Museum.

Distributed over much of tropical Africa; South African examples

average about the dimensions given above, but the var. ingens Ancey from Nyasaland is  $88 \times 65$  mm. in height and breadth.

Although founded on a specimen received from Peters, the original description is by Troschel, with no allusion as to other authorship, which must therefore be attributed to him.

The Victoria Falls locality must be expunged from my Reference List, as it refers to the following species.

Lanistes ellipticus Mts. (Pl. xvii, f. 15.) Ref. List No. 545.

1866. Lanistes ellipticus Mts., Novit. Conch., ii, p. 294, pl. lxx, f. 9-10. D.F.

1886. Lanistes ellipticus Mts. var. trapeziformis Furtado, J. de C., xxxiv, p. 150. D.

1927. Lanistes (Meladomus) ellipticus Mts., P. & B., Bull. Amer. Mus. N.H., liii, p. 198, pl. xvii, f. 8. D.F.

Typically very distinct from ovum in its upright elliptical form, shouldered whorls, aperture vertical instead of rather diagonal, and strong angulation around the umbilicus. Although most of these points are stressed in Martens' description, there is little sign of them in his figure, which resembles ovum so closely that the two species have often been considered conspecific. The paratype figured on pl. xvii, however, demonstrates clearly the considerable differences between them, although intermediate forms are found which are difficult to determine. It is selected as having a perfect apex, contains  $4\frac{1}{2}$  whorls, and measures

Alt. 48.5, lat. 40.0; apert. alt. 32.0, lat. 25.0; last whorl 44 mm.

Hab. LORENZO MARQUES. Tette (type, Peters); below Tette (trapeziformis, Capello & Ivens).

S. RHODESIA. Victoria Falls (Connolly); mouth of Chobe River (Holub).

Type in Berlin Museum.

Lanistes olivaceus (Sow.). (Pl. xvii, f. 14.)

Ref. List No. 548.

1834. Paludina olivacea Sow., Gen. Shells, pt. 41, pl. clxxxiii, f. 3. D.F.

1839. Ampullaria purpurea Jonas, Arch. f. Naturg., v, i, p. 342, pl. x, f. 1. D.F.

1839. Bulimus tristis Jay, Cat. Shells, p. 121, pl. vii, f. 1. N.F.

1840. Meladomus bulimoides Swains., Treat. Malac., p. 340. D.

1866. Lanistes olivaceus Sow., var. procerus Mts., Novit. Conch., ii, p. 292, pl. lxxi, f. 1-2. D.F.

1916. Lanistes olivaceus Sow. (= purpurea Jonas, tristis Jay, bulimoides Swains., pyramidalis Let., procerus Mts., nitidissimus and bloyeti Bgt.), Sow., Proc. Mal. Soc., xii, p. 68. Synonymy.

1925. Lanistes olivaceus Sow., Conn., Trans. R. Soc. S. Africa, xii, p. 208. N.L.

Differs widely from other species in its produced spire with straight regular sides and acute apex. Colour similar to orum, frequently with the same narrow orange infrasutural line. Whorls 7, convex, but far less so than in ovum, sculpture as in that species, suture shallow. Aperture vertical, labrum straight in profile, columella straight and erect, margin scarcely reflexed, but there is practically no perforation. An average example from Zanzibar measures

Alt. 59, lat. 35; apert. alt. 30, lat. 22; last whorl 43 mm., but the species ranges

in var. procerus up to 93 × 71 mm.

Hab. LORENZO MARQUES. Tette (Peters). Original locality not mentioned; type ubi?

## Family VIVIPARIDAE

(= Paludinidae).

Shell turbinate, corneous, olive-green or -brown, sometimes banded, peristome simple, operculum thin, corneous, concentric throughout or with paucispiral nucleus. Tentacles acute, equal in the female, the right often truncate or recurved in the male, when it serves as a penis; eyes on low swellings at posterior base of tentacles; there are 2 cervical lobes, the right longer and serving as siphon, foot truncate in front, rounded behind. Cerebral ganglia united by a labial commissure; pedal centres in form of ganglionated cords; otocysts with many otoconia. Central tooth of radula wide, without basal denticles, laterals rhomboid, marginals narrow, cusps small. Viviparous; living in fresh water.

> Genus Viviparus Montf., 1810 (Conch. Syst., ii, p. 247)

(=Paludina Lam., 1812, Viviparella Raf., 1815, and Bellamya Jouss., 1886).

Type V. fluviorum Montf. (H. vivipara Lin.).

Shell of moderate size or rather large, ovate or globosely conic; aperture shortly ovate; peristome straight in profile; operculum corneous, with nucleus near inner edge.

Viviparus sambesiensis Stur.

(Pl. xvii, f. 17.)

Ref. List No. 551.

1898. Vivipara unicolor Oliv., var. sambesiensis Stur., S.A. Moll., p. 85, pl. iii, f. 57-61. D.F.

1905. Vivipara densestriata Prest., Proc. Mal. Soc., vi, p. 300, f. 2. D.F.

Shell comparatively large, acuminate ovate, narrowly umbilicate, smooth to the eye, rather glossy, olive-green or -brown, interior brown, divided by a narrow white band from the black peristome. Spire produced, apical angle about 67°, apex acute. Whorls 6, convex, rapidly increasing, very bluntly angled at periphery except near aperture, first  $1\frac{1}{2}$  apparently smooth, remainder sculptured all over with very fine and close, straight, slightly oblique transverse striae and fine, equally close, raised spiral lines, some of which bear short, rather distant bristles, which usually drop off in dry condition, leaving tiny black dots to show their original position; suture simple, well defined. Aperture suboval, peristome simple, acute, labrum straight and receding slightly in profile, columella concave, margin extremely narrowly reflexed, obscuring but little the narrow umbilicus. The shell described measures

Alt. 27.4, lat. 19.9; apert. alt. 13.9, lat. 11.1; last whorl 21.5 mm., while Sturany gives dimensions ranging from  $27 \times 22.5$  to  $27 \times 18.5$  mm. in height and breadth.

Operculum thin, corneous, pale brown, nucleus near inner and a little more than half-way from upper margin, concentric striae very close, fine, and numerous: alt. 11.8, lat. 8-9 mm.

Hab. S. RHODESIA. Victoria Falls (sambesiensis, Penther; densestriata, Morrell).

Type of sambesiensis in Vienna, densestriata in British Museum.

 $\label{linear_virial} Viviparus\ capillatus\ {\tt Frnfd}.$ 

(Pl. xvii, f. 18.)

Ref. List No. 549.

1865. Vivipara capillata Frnfd., P.Z.S., p. 659. D.

1919. ,, ,, , (=zambesiensis Stur. and densestriata Prest.), Germ., Bull. Mus. Paris, p. 52. D.

1920. Vivipara capillata Frnfd., Germ., Voy. Babault, p. 224. D.F.

1925.  $Vivipara\ capillata\ Frnfd.$ , Conn., Trans. R. Soc. S. Africa, xii, p. 208. N.

1936. Viviparus (Bellamya) unicolor capillatus Frnfd., Haas, Abh. Senckenb. Ges., No. 431, p. 38, pl. ii, f. 3. F.L.

Agrees with the foregoing in all respects, except for being typically smaller, narrower, and with possibly weaker sculpture. The type measures

Alt.  $22\cdot3$ , lat.  $16\cdot1$ ; apert. alt.  $11\cdot0$ , lat.  $8\cdot8$ ; last whorl  $17\cdot0$  mm., apical angle ca.  $67^{\circ}$ .

Hab. ZULULAND. Lake Sibayi (Toppin).

S. RHODESIA. Near Victoria Falls (Morrell).

LORENZO MARQUES. Rikatla; L. Pavi; L. Mhandlen (Junod). Type in British Museum.

Probably conspecific with sambesiensis, while average specimens agree in form with the Nilotic unicolor Oliv., which, if actually distinct, it replaces in the Zambesi basin, and may possibly be separable by possessing more frequently distinct spiral sculpture, which is usually almost undecipherable in the northern species.

# $Viviparus\ leopold villens is\ ({\tt Putz.}).$

(Pl. xvii, f. 19.)

1898. Paludina leopoldvillensis Putz., Bull. Soc. Mal. Belg., xxxiii, p. xxii, f. 1-2. D.F.

1909. Vivipara leopoldvillensis Putz., Kob., Conch. Cab., p. 380, pl. lxxv, f. 10–11.  $\,$   $\,$  D.F.

1920. Vivipara leopoldvillensis Putz., Germ., Voy. Babault, p. 214. D.

1927. Viviparus leopoldvillensis Putz., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 207. N.

1930. Viviparus leopoldvillensis Putz., Conn., Ann. S.A. Mus., xxix, p. 319. N.

Shell solid, dull, nearly imperforate, black-brown or -green, attaining much greater size than sambesiensis, though owing to the apex being eroded, as it was in the type set, in all examples I have seen, I am unable to give exact dimensions or number of whorls. Sculpture as in sambesiensis, but spirals extremely strong, a few spines visible in some specimens; suture somewhat impressed. Aperture more or less suboval, with frequently a distinct angle at junction of basal margin with the columella, which is concave, upper margin, though very narrowly reflexed, practically obscuring the minute rima. A large example measures

Alt. ca. 35·0, lat. 25·2; apert. alt. 17·2, lat. 13·5; last whorl 24·4 mm.

Hab. OVAMBOLAND. Junction of Okovango and Omuramba-Omataka Rivers (Shortridge).

Type in Tervueren Museum.

Described from Stanley Pool, near Leopoldville, Belgian Congo.

Viviparus passargei Mts.

(Pl. xvii, f. 16.)

Ref. List No. 550.

1904. Vivipara passargei Mts., Die Kalahari, p. 755, f. 3; p. 757. F.D.

1936. Viviparus (Bellamya) passargei Mts., Haas, Abh. Senckenb. Ges., No. 431, p. 38, pl. ii, f. 2. F.L.

Founded on a single subfossil example, said to be moderately umbilicate, with 6 hardly convex whorls, the upper shouldered, without sculpture, last with blunt peripheral angle, which dies out towards the aperture, and another round the umbilicus; suture fairly deep.

Alt. 32, lat. 24; apert. alt. 17, lat. 13 mm.

Hab. BRITISH BECHUANALAND. Letter Tree, Botletle (subfossil in marly sandstone, Passarge); 8 feet above flood plain of Linyanti R., near Kabulabula (subfossil, Rogers).

Recorded and figured by Haas from the Okavango District, South Angola.

Type ubi?

The rediscovery by Rogers of this little-known fossil, in the same river system and not more than 120 miles from the type locality, enables me to present a better illustration than the original; it has 5 whorls, strongly biangulate, at shoulder and periphery, until nearing the aperture, the intermediate whorl area being almost flat; there are the remains of close, nearly vertical striation on the later whorls crossed by extremely close, fine spiral grooves; suture well defined. Aperture quadrate, very narrowly rounded at base, but this may be abnormal.

Alt. 32, lat. 22; apert. alt. 15.5, lat. 14.0; last whorl 25 mm.

In according full specific rank to the four species yet recorded from South Africa, I do so with fullest deference to the many high authorities who have, probably with reason, expressed views as to their synonymy. There is no doubt that far too many forms, not varietally distinct, have been magnified into "species" from both sides of the continent, but the opinions so far expressed are so diverse that it may be advisable for the present to refrain from embarking upon this very difficult matter.

#### FAMILY THIARIDAE.

#### (= Melaniidae).

Shell usually ovate or turrited; aperture oval; operculum corneous, paucispiral, at least in young, but sometimes becoming concentric. Animal with a broad muzzle; tentacles slender, with the eyes at their outer bases; foot short; no external male organ; pedal ganglia concentrated; central tooth of radula short, usually without basal denticles, admedian with the outer angle of the base obliquely elongated.

#### Subfamily CLEOPATRINAE.

Shell usually ovate; operculum concentric, with a spiral nucleus; mantle-edge smooth; otocysts with otoconia; radula very small. An

African fresh-water group closely related to the Oriental subfamily Paludominae, in which, however, the mantle-edge is fringed.

Genus Cleopatra Troschel, 1857 (Gebiss der Schnecken, i, p. 100). Type Cyclostoma bulimoides Oliv. (=Zanguebaria Fischer, 1881).

Shell small to medium, ovate or turriform, of few whorls. Operculum concave, corneous, mainly concentric but with a small spiral nucleus of about  $1\frac{1}{2}$  whorls half-way up near the columellar side. Radula minute, central tooth with numerous denticles and plain body, remaining teeth each having about 7–9 denticles.

## Cleopatra bulimoides (Oliv.).

1804. Cyclostoma bulimoides Oliv., Voy. Emp. Ott., iii, p. 68, Atlas, pl. xxxi, f. 6. D.F.

Although it has not yet been noticed to occur in South Africa, it is necessary to describe the typical Egyptian form of this species before turning to the varieties which follow.

Shell of moderate size, rimate, acuminate ovate, solid, smooth, rather glossy, green, brown, or buff, with or without a varying number of dark purple bands. Spire moderately produced, sides straight and regular, apical angle about 56°, apex very narrowly rounded. Whorls 7, convex, regularly increasing, sculptured with close, fine vertical striae crossed by nearly as close and fine microspiral grooves; suture well defined. Aperture ovate, peristome simple, labrum straight and vertical in profile, columella white, erect, concave, margin more or less narrowly reflexed over the narrow rima; operculum not much smaller than aperture.

Alt. 16.2, lat. 8.6; apert. alt. 7.4, lat. 3.8; last whorl 10.8 mm.

#### var. welwitschi Mts.

1868. Paludina bulimoides Oliv., Morel., Voy. Welwitsch, p. 96. N.

1897. Cleopatra bulimoides Oliv., var. welwitschi Mts., D.O.A., iv, p. 185. D.

1930. Cleopatra bulimoides Oliv., var. welwitschi Mts., Conn., Ann. S.A. Mus., xxix, p. 320, pl. iii, f. 32. N.F.

The upper whorls are very slightly less convex than in type and increase more regularly in diameter, so that the 2 penultimate are noticeably smaller than in Nilotic examples; the rima is practically absent, being almost obliterated by the narrow reflexion of the columellar margin. The Ovambo specimens are bleached but agree in form with Angola originals. A large example measures

Alt. 17.4, lat. 9.8; apert. alt. extern. 8.0, lat. 4.3; last whorl 12.2 mm. VOL. XXXIII. 36

Hab. OVAMBOLAND. Upper reaches of Omuramba-Omataka R. (Shortridge).

Described from Angola.

Type in Berlin Museum.

#### var. richardi Germ.

1911. Cleopatra bulimoides Oliv., var. richardi Germ., Docs. Sci. Miss. Tilho, ii, p. 200, pl. ii, f. 5-6. D.F.

1916. Cleopatra bulimoides Oliv., var. richardi Germ., Docs. Sci. Miss. Tilho, p. 305, pl. i, f. 3-4. D.F.

1930. Cleopatra bulimoides Oliv., var. richardi Germ., Conn., Ann. S.A. Mus., xxix, p. 321, pl. iii, f. 26. N.F.

Described as rather a large form with very convex whorls and far narrower than type, with deep suture, sometimes with 2 spiral keels on the 3rd and 4th whorls, which gradually disappear, leaving the last smoothly rounded. The Ovambo series are considerably shorter, but agree so well otherwise with richardi, even to the peculiar evanescent double carination on the 3rd and 4th whorls, that they obviously represent a small race of Germain's variety. An example with 6 convex whorls measures

Alt. 10.9, lat. 4.7; apert. alt. 3.8, lat. 2.4; last whorl 5.8 mm.

Hab. OVAMBOLAND. Upper reaches of Omuramba-Omataka R. (Shortridge).

Described from Lake Chad and recently recorded from the Kharga Oasis, Egypt.

Type in Paris Museum.

# Cleopatra morrelli Prest.

Ref. List No. 553.

1905. Cleopatra morrelli Prest., Proc. Mal. Soc., vi, p. 300, f. 3. D.F.

1925. Cleopatra morrelli Prest., Conn., Trans. R. Soc. S. Africa, xii, p. 209. L.

Differs from bulimoides, which it resembles in size and contour, in having much flatter whorls; the decoration on a buff ground usually consists of 2 or 3 narrow bands of purple at and above the periphery and a broader one near the base; the sculpture of close vertical striae crossed by fine microspiral grooves is very strong; the base is evenly rounded without contraction and the very narrow reflexion of the columellar margin leaves a minute rima.

Hab. S. RHODESIA. Victoria Falls (type, Morrell). LORENZO MARQUES. Wanetsi R., Majude Dist. (Bell Marley). Type in British Museum. var. costata Prest.

Ref. List No. 553.

1905. Cleopatra morrelli var. costata Prest., Proc. Mal. Soc., vi, p. 300, f. 4; p. 301. F.D.

A much rubbed and weathered individual with all but the last whorl eroded, which may account for the striation appearing rather stronger than in fresh examples.

Hab. S. RHODESIA. Victoria Falls (Morrell). Type in British Museum.

Cleopatra ferruginea (Lea). Ref. List No. 552 (numbered in error 522).

1850. Melania ferruginea Lea, P.Z.S., p. 182. D.

1925. Cleopatra ferruginea Lea, Conn., Trans. R. Soc. S. Africa, xii, p. 208. N.

Note.—I do not repeat the synonymy assigned to this species by various authors and cited in my previous lists, since its limits of variation and distribution are by no means clearly defined, and as all South African examples examined by me appear to be fairly typical of Lea's species there is no occasion for complicating matters with references to others described from East Africa, some of which may be specifically distinct from that now under consideration.

Shell of fair size, turriform, scarcely rimate, solid, smooth, glossy, dark buff or reddish brown, unicoloured in the type, but usually with a rather broad purple band round the periphery and sometimes another round the base. Spire produced, sides straight and regular, apex acute. Whorls about 9 when all present, rounded at periphery, moderately convex, sculptured with close, slightly curved, nearly vertical growth lines, cut by close, fine, regular, slightly undulating spiral grooves; suture well defined. Aperture acuminate ovate, typically evenly rounded and only very slightly expanded at base, labrum nearly straight and vertical in profile, columella erect, slightly concave, margin scarcely reflexed but extending across paries in a white callus, rima nearly non-existent. A well-grown typical example measures

Alt. 24, lat. 11.5; apert. alt. 10.9, lat. 5.5; last whorl 15.2 mm.

Hab. ZULULAND. Manuan Creek (Anderson); Ototolini District (Bell Marley).

LORENZO MARQUES. R. Quaqua, near mouth of Zambesi (Stuhlmann); Itschongove (fide Sturany); L. Mhandlen; L. Schwabe (Junod).

CAPE PROVINCE. Prieska (Gibbons, fide M. & P.). Type in British Museum.

Described from Zanzibar; a distinguishing feature of the type of this species is the rounded and regular base, which may perhaps be of specific value in separating it from others in which the base is somewhat prolonged downwards and contracted, almost forming a channel; both types of base, however, may be found among individuals from the same series and it is often difficult to draw a line between them.

## Subfamily THIARINAE.

Shell usually elongate oval or turrited, imperforate, operculum paucispiral with basocolumellar nucleus; animal with fringed mantle-edge; otocysts each with a single otolith; radula small and short. Fresh-water or estuarine forms, usually viviparous.

Genus *Thiara* Röding, 1798 (Mus. Bolten., ii, p. 109). Type *Helix amarula* Linn.

Ovate shells decorated with a crown of stumps, generally extending into spicules, around the shoulder of each whorl.

Thiara vouamica (Bgt.). Ref. List Nos. 554, 555.

1780. Helix amarula "Lin.," Born, Test. Mus. Caes. Vindobone, p. 391, pl. xvi, f. 21. D.F.

1787. Strombus coactus Meusch., Mus. Geversianum, p. 294. D. (Non-binomial.)

1859. Melania crenularis "Desh.," Mts., Mal. Blätt., vi, p. 216. L. 1877. ,, thiarella Lam. (=coactus Meusch.), Brot, Conch. Cab., p. 291, pl. xxix, f. 3. D.F.

1879. Melania crenularis "Desh.," Mts., Monatsb. Ak. Wiss. Berlin, p. 733. L.

1889. Tiara crenularis Desh., var. vouamica Bgt., Moll. Afr. Équat.,

1897. *Melania coacta* Meusch., Mts., D.O.A., iv, p. 197, pl. vi, f. 36. *D.F.* 

1915. Tiara coacta Mts., Conn., Ann. S.A. Mus., xiii, p. 100. N.

1921. Melania (Melania) amarula Lin., var. coacta Meusch., Germ., Faune Mascareignes, pp. 360, 361. N.

1925. Tiara coacta Mts., Cawst., J. Trop. Med. Hyg., xxviii, p. 365.

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1925. Tiara coacta Mts., Cawst., Ann. Trop. Med. Parasit., xix, p. 217, f. 8. F.

1925.  $Tiara\ vouamica\ \mathrm{Bgt.}\ (=coacta\ \mathrm{Mts.}),\ \mathrm{Conn.},\ \mathrm{Trans.}\ \mathrm{R.}\ \mathrm{Soc.}$  S. Africa, xii, p. 209. N.

Shell large, acuminate subovate, imperforate, solid, smooth, moderately glossy, green or brown. Spire somewhat exserted, sides gradate, apex acute. Whorls about 9, first 4 or 5 usually deficient, regularly increasing, nearly flat, strongly shouldered, encircled at the shoulder by a row of low blunt stumps or protuberances which do not prolong into spicules, varying somewhat in distance apart, the specimen described having 9 round the last and 10 round the penultimate whorl, sculpture consisting of close vertical growth striae crossed to a varying extent by far less close spiral costulae of irregular occurrence, being sometimes present all over every whorl, including the stumps, and more usually only apparent on the lower portion of the last whorl; suture simple, well defined. Aperture vertical, long and narrow, interior bluish white, peristome simple, labrum vertical and hardly curved in profile, base very narrowly rounded, columella short, concave, curving smoothly into the paries; operculum as in genus.

Alt. ca. 33, lat. 15·5; apert. alt.  $17\cdot3$ , lat. (intern.)  $7\cdot0$ ; last whorl  $25\cdot0$  mm.; operculum  $10\times4$  mm. Another shell of the same set, with about the same length, is

17.2 mm. broad.

Hab. LORENZO MARQUES. Estuary of Komati R.; Rikatla (Junod).

NATAL. Izezela (Sweeney); Umkomaas (Burnup); Amanzintoti River and lagoon; Amahlongwa R., 2 miles from Scottburgh (Cawston); Ifafa (Akerman).

As the Natalian examples ascribed to amarula in my Reference List have since been proved to be *vouamica*, the former must be expunged from the local list.

The present species occurs in several localities up the east coast of the continent as far north as Somaliland; it differs from amarula in bearing short blunt stumps rather than spines.

Genus Melanoides Oliv., 1804
(Voy. Emp. Ott., iii, p. 69).

Type M. fasciolata Oliv. (Nerita tuberculata Müll.)
(= Melania auctt., non Lam.).

Shell long and slender with both axial and radial sculpture, at least on the earlier whorls; operculum ovate, paucispiral, nucleus near basocolumellar margin; all teeth of radula with numerous denticles, central short and wide, marginals with long bases.

## Melanoides tuberculata (Müll.). Ref. List No. 557.

1774. Nerita tuberculata Müll., Verm., ii, p. 191. D.

1859.  $Melania\ inhambanica\ Mts.,\ Mal.\ Blätt.,\ vi,\ p.\ 216,\ pl.\ ii,\ f.\ 10.\ D.F.$ 

1919. Melania (Melanoides) tuberculata Müll., Germ., Bull. Mus. Paris, p. 119. N.

1922. Tiara tuberculata Müll., Cawst., S. Afr. J. Sci., xviii, p. 397. N.

1925. Melanoides tuberculatus Müll., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. F.R.

1925. Melanoides tuberculata Müll., Cawst., Ann. Trop. Med. Parasit., xix, p. 217, f. 6. F.

1925. Melanoides tuberculata Müll., Cawst., Trans. R. Soc. S. Africa, xiii, p. 41, pl. iv, f. 1. N.F.R.

1925. Melanoides tuberculata Müll., Conn., Trans. R. Soc. S. Africa, xii, p. 210. N.

1926. Melania (Melanoides) tuberculata Müll., Germ. & Nev.-Lem., Ann. Parasit., iv, p. 302. D.F.

1927. Melanoides tuberculata Müll., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 256, pl. xxi, f. 1–7. N.F.

1928. Melanoides tuberculata Müll., Conn., Atti. Soc. Modena, p. 128. N.

1929. Melanoides tuberculata Müll., Faust, Human Helminthology, p. 562. N.

1930. Melanoides tuberculata Müll., Conn., Ann. S.A. Mus., xxix, p. 320. L.

1932. Melanoides tuberculata Müll., Blackie, Mem. London Sch. Trop. Med., v, p. 34, pl. i, f. 5. N.F.

1936. Thiara (Melanoides) tuberculata tuberculata Müll., Haas, Abh. Senckenb. Ges., No. 431, p. 40. L.

Note.—The literature concerning this widely diffused species would fill folios; the additional references cited above refer to its occurrence within, or near, the limits of the present work. The synonymy of Asiatic forms was dealt with in my Reference List.

Shell elongate turriform, imperforate, asperate, dull, solid, corneous buff or brown, almost unicoloured or with irregular spots or blotches of red, and rarely a supersutural rufous band. Spire produced, varying greatly in obesity, sides straight, apex acute. Whorls 10–12, convex, regularly increasing, with strong, regular, spiral costae below the periphery, encircling the base, the sculpture above the periphery consisting of close, curved, regular, transverse striae, usually almost

obscured by a superstructure of close, strong spiral costae and transverse ridges, which form as a rule at the points of intersection strong tubercles, frequently red in colour; this transverse superstructure is, however, irregular, both in strength and occurrence, and is usually very weak or absent, especially on the later whorls, in South African examples; suture of varying depth. Aperture acuminate ovate, peristome simple, acute, labrum slightly receding just below the suture, thence evenly arcuate to base, columella weak, concave, usually merging into a white callus.

Adult examples may vary in size from  $15 \times 5$  to  $45 \times 14$  and  $47 \times 12\frac{1}{2}$  mm. in length and breadth; the generality of Natal specimens do not exceed about 32 × 10 mm., but the largest I have examined from Zangwe Basin is 42 × 14 mm.

The operculum is far smaller than the aperture.

Hab. NATAL. Umgeni Lagoon (Burnup); Prospect Hall and Illovo; Amahlongwa R., Scottburgh; Amanzintoti Lagoon (Cawston). ZULULAND EAST (Burnup).

S. RHODESIA. Fungwe Reserve, Mrewa District (Blackie).

LORENZO MARQUES. Inhambane; Tette (Peters); L. Pavi; Lebombo Marsh, Rikatla (Junod); Zangwe Basin (Cressy).

TRANSVAAL. Komati District (inhambanica, Schenck, fide Martens); Middelburg (fide Crawford); Krüger Park (Haas).

BRITISH BECHUANALAND. Makarrikarri Pan; Lake Ngami; Botletle District; Mori Mossetla, Ngami River (fossil, Passarge).

DAMARALAND. Namutoni (Barnard).

Described from Coromandel and very widely distributed over Africa and parts of Asia, south coasts of the Mediterranean, Java, Borneo, and other islands of the Indian and Pacific Oceans.

## Melanoides victoriae (Dhrn.). Ref. List Nos. 556, 558.

1865. Melania victoriae Dhrn., P.Z.S., p. 234. D.

1894. crawfordi Brot, J. de C., xlii, p. 473, pl. ix, f. 5. D.F.

1930. Melanoides victoriae Dhrn., Conn., Ann. S.A. Mus., xxix, p. 320. L.

Typically smoother than the foregoing, the transverse costulae, especially on the later whorls, giving place to close fine striolae and the spiral sculpture absent above the periphery, though the strong basal grooves are always present; similar sculpture, however, is apparent in many more northern races attributable to Müller's species and may not be of specific value in the South African forms. M. victoriae in its extreme form is nearly smooth above the periphery of even the earlier whorls, crawfordi usually on the last 2 or 3 of well-grown shells, but some individuals of the one species coincide with those of the other. A well-grown example with 9 moderately convex whorls measures

Alt. 29.0, lat. 9.8; apert. alt. 9.5, lat. 4.8; last whorl 15.2 mm., which represents

the average proportions of these two smoothish forms, which are far less variable in contour than most races of *tuberculata*.

The animal of victoriae is viviparous.

Hab. S. RHODESIA. Victoria Falls (victoriae, Kirk and others). OVAMBOLAND. Kunene R., near Great Falls (Barnard).

TRANSVAAL. Middelburg (crawfordi, Crawford); Hennops R. and Crocodile R., Pretoria District (Connolly).

CAPE PROVINCE. Sunday's River, Port Elizabeth (fide Crawford!!).

Types in British Museum.

My sole reason for preserving at least one of the two names now united is because these inland forms are smoother and less tuberculate than that which appears to be extending its range westward along the coast of Natal and is so common in fossil condition about the Kalahari.

#### FAMILY TRUNCATELLIDAE.

Shell small, cylindrical or turreted; snout very long, bilobed; foot very short; eyes at base of the tapering tentacles; central tooth of radula somewhat triangular, with a single anterior cusp and accessory basal denticles; lateral and marginal teeth as in the next family, to which this one appears to be very closely related.

Genus *Truncatella*, Risso, 1826 (Hist. nat. Europe mérid., iv, p. 124).

Type T. laevigata Risso (Helix subcylindrica Linn.).

Shell turriform, imperforate, upper whorls almost always wanting, peristome thickened, continuous; operculum ovate, paucispiral with sub-basal nucleus, inner surface concave, smooth, corneous, outer convex, with membranaceous border but a thick opaque semi-calcareous deposit on the centre. Animal with a gill, but apparently amphibious, living on the seashore.

In place of Risso's name for this genus, some authors have recently adopted Acmea Hartmann, 1821, as having five years priority, and have consequently altered the family name to Acmeidae; but the matter has been referred to the International Commission on Nomenclature, and while it is still sub judice it is obviously inadvisable to depart from Risso's old established name in the present work.

#### Truncatella teres Pfr.

Ref. List No. 562.

1856. Truncatella teres Pfr., P.Z.S., p. 336. D.

" Germ., Faune Mascareignes, p. 377. D. 1921.

Shell small, imperforate, solid, decollate, asperate to smooth, chestnut-brown or buff. Spire produced, sides straight and nearly parallel, summit deprived of apical whorls, obtusely rounded, or with jagged edge where the preceding whorl has broken off. Whorls remaining ca.  $3\frac{1}{2}$ , summit smooth, sides sculptured with strong, regular, more or less straight, vertical costae, 11 to 12 visible on face of body whorl, and usually extending across from suture to suture, but occasionally only half-way down or almost entirely absent; suture subcrenulate. Aperture subovate, peristome continuous, slightly thickened, columella short, concave, thickened and extending across paries. The torso of a Port Elizabeth example measures

Long. 6.7, lat. 2.5; apert. alt. 1.8, last whorl 3.2 mm.

Two detached spires from Rodriguez, consisting of the apical whorls, are small, narrow, much elongate turriform, 7 minute whorls, first 2 with very close, fine, regular, straight vertical riblets, remainder sculptured as in torso; they measure  $5.2 \times 1.6$  mm. The division between the fine, close riblets of the 2 apical and the coarse costae of the later whorls is very distinct and worthy of note.

Hab. CAPE PROVINCE. Port Elizabeth (Crawford; Penther; Farquhar).

Type in British Museum.

First recorded from Mauritius and Australia; also known to me from the Red Sea, Rodriguez I., and Gazi, Kenya Colony, whence Preston distributed it under a MS. name in honour of Iredale.

#### FAMILY HYDROBIIDAE

(=Paludestrinidae).

Shell small, usually ovate-conic or turreted. Tentacles slender with the eyes at their outer bases; penis some distance behind the right tentacle and often appendiculated; nervous system somewhat concentrated; otocysts with single otoliths. Central tooth of radula with accessory cusps on each side of its broad base; laterals with the hinder part of base prolonged outwards; marginals multicuspid. Inhabits fresh or brackish water.

This family now presents a very different aspect from what it did in my Reference List, where it appeared under the name of Paludestrinidae. The genus Paludestrina Orbigny, 1840, a name which now gives place to Hydrobia Hartmann, 1821, was then supposed to include three South African species, tristis and alabastrina Morel. and zwellendamensis Küst., to which I added later rogersi mihi, on account of its resemblance to tristis. It will be seen, however, that zwellen-damensis, rogersi, and tristis appear from their radula best placed in Tomichia, leaving only alabastrina to represent the genus Hydrobia; but this ill-founded species may well belong to any of two or three distinct families and certainly does not merit the retention of Hydrobia in the S. African list on its account alone. Hartmann's genus can be therefore eliminated, but on the other hand Tomichia is transferred from the Truncatellidae to the present family and takes in all the above-mentioned forms.

Hugh Watson has recently examined the South African members of this family, and I am deeply indebted to him for permission to publish the results in these pages. Not only are the full-page figures 47 and 48 his personal contribution, but he is also responsible for the arrangement, which I have adopted, of the species and for those parts of the text that I have placed in inverted commas.

Genus *Tomichia* Bs., 1851 (A.M.N.H., vii, p. 378).

Type Truncatella ventricosa Rve.

"Shell small, turriform or acuminate-ovate, often decollate; peristome practically continuous when fully developed, usually somewhat sinuous when viewed in profile, curving backwards below the suture and then forwards towards the base. Operculum thin, corneous, paucispiral, its nucleus near the base towards the left side.

"Animal with an elongated snout; 2 filiform tentacles with blunt points; eyes on slight swellings at bases of the tentacles; foot short, ovate; penis large, tapering, without an appendix, arising from the top of the back of the neck and often coiled into a loose spiral within the mantle-cavity. Radula formula 2+1+1+1+2; central tooth with about 2 ectocones on each side of the larger mesocone, and having 2 or 3 basal denticles on each side, of which the innermost is usually much the largest; base of central with a thin median continuation extending under the front of the succeeding tooth; lateral with about 2 small endocones and about 3 ectocones in addition to the mesocone; marginals each with 7-13 small denticles and a long base, so that the teeth of succeeding rows overlap. Inhabiting lakes, pools, or streams of fresh or brackish water, mainly near the south coast.

"Pilsbry and Bequaert have proposed the subfamily Tomichiinae for this genus, but recent researches suggest that it is nearer the typical members of the family than they supposed." The known members of this genus can be at present divided into two natural geographical groups, distinguished by their radulae.

"(i) Species from the south and west of the Cape Province.

"Central tooth of radula with the median continuation of the base broader than long; inner marginals usually with more denticles than the outer marginals.

"Although the members of this group have been assigned to three different families, they are in fact so nearly related to one another that it is difficult to be certain how many of them should be regarded as even specifically distinct. The more ovate forms seem to be the most primitive, but probably owing to the way in which their habitats partially dry up at times there appears to be a tendency for the shells to become longer and even subscalariform, and more markedly decollate. This tendency seems to have occurred independently in different species or races, sometimes affecting all the individuals and sometimes only a few of them, and has resulted in a number of forms with somewhat similar elongated shells, but probably of different origin. These forms, however, can often be distinguished by their radulae, and this organ is therefore dealt with more fully than usual in the present genus. But the radula is also subject to individual variation, the length of the cusps often varying considerably in different specimens of the same species; and it may even change its character to some extent during the life of the same individual, so that in some adult specimens of Tomichia the teeth near one end of the radula may differ from those near the other end much more than can be due to wear and tear. To solve the problems presented by these interesting species, the radulae of specimens from more localities should be examined, the influence of the environment (salinity, pH, temperature, etc.) on both the radula and the shell should be studied, and the recent shells compared with their subfossil ancestors, which in places are so abundant as to form masses of shell brecchia, such as are found in the Calvinia district and in Little Namaqualand."

> Tomichia zwellendamensis (Küst.). (Text-figs. 47, E; 48, E.) Ref. List No. 561.

1852–53. Paludina zwellendamensis Krs., Küst., Conch. Cab., p. 53, pl. x, f. 19–20. D.F.

Shell very small, elongate turriform, imperforate, smooth, dull, semitransparent, corneous buff or reddish brown. Spire elongate, sides straight, apex very narrowly rounded. Whorls 7–8, not very convex, slowly increasing, first smooth and glossy, remainder dull, showing traces of very faint irregular growth lines, suture shallow. Aperture acuminate ovate, peristome simple, labrum as usual in the genus, columella concave, without marginal reflexion, produced upwards in a thin white callus. The specimen figured, with 7 whorls, is of average size; one with 8 whorls measures

Long. 6.75, lat. 2.0; last whorl 3.0 mm.

Hab. CAPE PROVINCE. Lakes and streams in the Zoetendal Valley (Krauss); Zoetendal Vlei, Bredasdorp District (Barnard).

Type ubi?

"Radula (fig. 48, E) of two specimens from Zoetendal Vlei, with

57-59 rows of teeth. Formula of denticles: 8, 12-13, 6-7,  $\frac{5}{2}$ , 6-7,

12-13, 8. Mesocone of central tooth large and very broad, but blunt, even where unworn; mesocones of laterals also large.

"The thin slender shell differs from those of the other elongate members of this group by being imperforate, and by the much smaller convexity of its lower whorls. In the specimens examined only the apical whorls tend to be decollate; the colour varies from reddish brown to pale straw.

"When describing this species, Küster erroneously supposed that Krauss, who discovered it, had named it in his Südafrik. Mollusken."

Tomichia producta Conn.

(Text-figs. 47, D; 48, C and D.)

Ref. List No. 563 (pars).

1912. Tomichia ventricosa Rve., var. brevis Krs., Conn., Ann. S.A. Mus., xi, p. 267. L.

1929.  $Tomichia\ producta$  Conn., Ann. Natal Mus., vi, p. 242, pl. xiv, f. 40. D.F.

A slender form, but rimate and with much more rounded whorls than the last species. The shell is thin, pale corneous, and in a slightly immature specimen which still retains the upper part of the spire there are 10 convex, slowly increasing whorls, the sculpture, where visible on the last 4, consisting of fairly regular, rather distant vertical costae; suture deeply impressed. Aperture oblique, oval; operculum so thin as to be almost gelatinous.

Long. 10.7, lat. 3.0; apert. alt. 2.3, lat. 1.5; last whorl 3.8 mm.

Hab. CAPE PROVINCE. Eerste River, Cape Flats (type, Connolly); Salt River Vlei, Bredasdorp; vlei between Hermanus and Onrust (Rennie).

CAPE PENINSULA. Kommetje Vlei (Barnard).

Type in British Museum.

"Radula of 2 specimens from Kommetje Vlei, with 63-64 rows of teeth (text-fig. 48, D). Formula of denticles: 9-10, 12-13, 7,  $\frac{3-5}{2}$ ,

6-7, 12-13, 9-10. The teeth are larger than in most forms; the mesocone of the central is very broad and large, though pointed; in the laterals the mesocone is also large, and united at its base not only with the adjacent endocone, as in other species, but also with the first ectocone. In a single specimen from Eerste River, the type

locality (text-fig. 48, C), the formula of the denticles is 9, 11, 7,  $\frac{5}{3}$ ,

7, 11, 9; and except that the central has a small third basal denticle on each side, the radula differs little from those from Kommetje Vlei.

"The shell is often as much decollated as the forms from Wild Bird Vlei, Riet Vlei, and Port Elizabeth usually are; and although it is normally narrower, with a deeper suture, and of a lighter colour, the specimens from Kommetje tend to grow broader, and to approach the form from the neighbouring Wild Bird Vlei in the shape of the shell, notwithstanding their different radula."

## Tomichia ventricosa (Rve.). (Text-fig. 49.) Ref. List No. 563.

1842. Truncatella ventricosa Sow., Rve., Conch. Syst., ii, p. 94, pl. clxxxii, f. 2. F.

1848. Truncatella ventricosa Sow. (=capensis Krs. in litt.), Krs., Südafr. Moll., p. 87, pl. v, f. 22. D.F.

1851. Tomichia ventricosa Sow., Bs., A.M.N.H., vii, p. 37. N.A. Trosch., Gebiss der Schnecken, i, p. 106, 1857. pl. vii, f. 15. R.

1885. Hydrobia caledonensis Chaper, Bull. Soc. Zool. Fr., x, p. 484, pl. xi, f. 6. D.F.

1914. Tomichia ventricosa Rve., Thiele, D. Südpol. Expn., xvi, pp. 99, 100, f. 1, b-c. D.F.A.R.

1925. Tomichia ventricosula Sow., Cawst., J. Trop. Med. Hyg., xxviii, p. 366. R.

1925. Tomichia ventricosula Sow., Cawst., Ann. Trop. Med. Parasit., xix, p. 216. N.

1928. Tomichia ventricosa Rve., Thiele, Zool. Jahrb., lv, p. 360, f. 5. R.

Shell small, elongate turriform, rimate, smooth, usually nearly semi-transparent, moderately glossy, corneous brown or buff. Spire produced; apex, when present, mamillate. Whorls about 8, convex, first 2 smooth, remainder covered with close vertical striolae of irregular strength; one or two of the later whorls sometimes become polyhedral, owing to the presence of one or several extremely obtuse spiral carinulae, which is not, however, a normal feature, while occasional varices sometimes occur in the lines of growth; suture simple, often deep. Aperture ovate, peristome simple, free and continuous, or neither, columella short, erect, concave, upper margin usually narrowly reflexed, forming a narrow rima. Operculum thin, corneous. The spire is nearly always decollate. Approximate dimensions for a complete shell with  $7\frac{1}{2}$  whorls are

Long. 8·3, lat. 3·2; apert. alt. 2·3, lat. 1·7; last whorl 4·3 mm.

Hab. Widely distributed near the south and west coasts of the Cape Province.

The foregoing is a somewhat composite description of what is probably a composite species. The forms that have been included in it resemble one another in being not so long and slender as the two preceding members of the genus, but more elongate than the remaining forms that have been given specific names. Yet in the other characteristics of their shells, and especially in their radulae, they differ sufficiently to suggest that at least some of them deserve specific rank quite as much as most of the Cape forms that are usually treated as distinct species. Nevertheless, until this difficult genus has been more fully investigated, it might seem better not to burden nomenclature with a number of new names, and I shall therefore do no more than give brief particulars of those forms of which both the radula and the shell have now been examined.

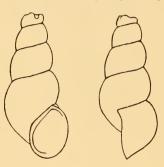
It is difficult to be sure exactly which forms the older authors each referred to as "ventricosa," or which one should be regarded as the typical form of the species.

No undoubted type can be discovered. The species appears to have been originally founded on specimens in the Sowerby collection, and inquiry from H. C. Fulton has elicited the kind reply that his late partner, G. B. Sowerby (3), knew nothing of the types of species described by his two predecessors of the same name; he only surmised that the specimens had been taken out of stock and put back again without any separation or indication of the importance of the type specimens. Reeve gave no locality for the species, and his figure does not entirely agree with any member of the group that we have seen. Krauss, from whom Pfeiffer received his specimens, collected forms of the species both on the Cape Flats and in the Zoetendal Valley, but apparently mixed them together. Benson therefore, in 1851, was the earliest author to mention a precise locality, as he

established the genus Tomichia on specimens which he took to be ventricosa collected by himself at Lakeside, or Muizenberg Vlei, a broad shallow pond on the direct main road from Cape Town to Simonstown, probably the first expanse of water in which any collector would make search when visiting the Cape Peninsula, and certain of the shells more recently collected by myself in the same locality are less unlike Reeve's figure than are any of the others that have come under notice; I am accordingly regarding these shells as typical of the species.

One of them, here proposed as neotype (text-fig. 49, below), is small, narrowly elongate turriform, rimate, smooth and glossy, fairly

solid, translucent, corneous yellowish brown. Spire produced, decollate, sides regular. Remaining whorls 4, convex, gradually increasing, practically devoid of sculpture; suture simple, deep. Aperture acuminate ovate, outer lip vertical, little sinuous in profile, columella slightly concave, margin narrowly reflexed upwards over the narrow rima; operculum very thin and weak. Long. 6.33, lat. 2.75; apert. alt. 2.33, lat. 1.66; last whorl 3.66 mm.



Text-fig. 49.—Tomichia ventricosa (Rve.), Lakeside. Neotype;  $\times$  6.

This shell appears to be an elongated specimen of the first of the following 6 forms, denoted by the Greek letters  $\alpha$  to  $\zeta$ , all of which have usually been included in T. ventricosa, although at least some of them may prove to be distinct species.

a (text-figs. 47, F; 48, F).

Hab. CAPE PENINSULA. Lakeside (Connolly).

"Radula of three specimens from Lakeside, with 46-67 rows of teeth (text-fig. 48, F). Formula of denticles: 9-10, 11-13, 6-7,

 $\frac{3}{2-3}$ , 6-7, 11-13, 9-10. Mesocones of central and lateral teeth rather large, that of the central being broad, but pointed, and varying in length.

"The shell is normally light brown, translucent, and specially characterised by its relatively smooth and even surface. It is often decollate. In the shell from which the figured radula was extracted

#### EXPLANATION OF TEXT-FIGS. 47 AND 48.

#### Text-fig. 47.

#### Shells of Tomichia ( $\times$ 6).

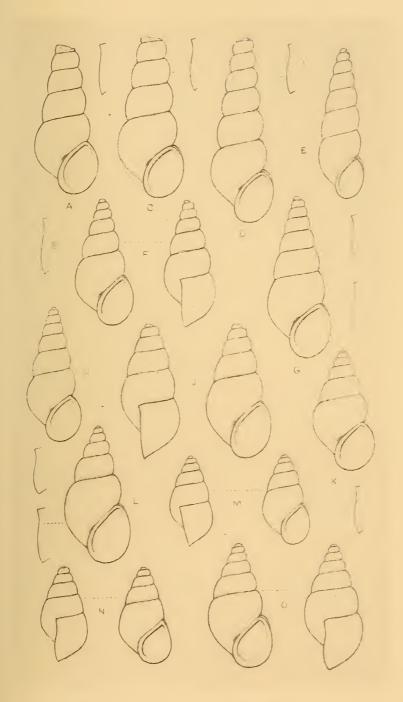
Note.—The small single-line drawings show the normal contour of the outer lip when fully developed and viewed from the side.

- A. T. "ventricosa"  $\zeta$ : Riet Vlei, N.W. of Cape Town. B. T. "ventricosa"  $\epsilon$ : Port Elizabeth (profile of outer lip only).
- C. T. "ventricosa" δ: Wild Bird Vlei, Noordhoek.
- D. T. producta Conn.: Eerste River, Cape Flats.
- E. T. zwellendamensis (Küst.): Zoetendal Vlei, Bredasdorp District.
- F. T. ventricosa (Rve.) α: Lakeside, Cape Flats.
- G. T. "ventricosa"  $\beta$ : Retreat (or Lange) Vlei, Cape Flats. H. T. "ventricosa"  $\gamma$ : Seekoe Vlei, Cape Flats.
- J. T. lirata (Turton): Kuils River, Cape Flats.
- K. T. tristis (Morel.): "South Africa."
- L. T. rogersi (Conn.): Stinkfontein, Little Namaqualand.
- M. T. differens Conn.: Walker Bay.
- N. T. cawstoni Conn.: Kokstad, Griqualand East.
- O. T. natalensis Conn.: Lower Umkomaas, Natal.

#### TEXT-FIG. 48.

Representative teeth from the radulae of different forms of Tomichia (× 430).

- A. T. "ventricosa" ζ: Riet Vlei, N.W. of Cape Town.
- B. T. "ventricosa" δ: Wild Bird Vlei, Noordhoek.
- C. T. producta Conn.: Eerste River, Cape Flats.
- D. T. producta Conn.: Kommetje Vlei, Cape Peninsula.
- E. T. zwellendamensis (Küst.): Zoetendal Vlei, Bredasdorp District.
- F. T. ventricosa (Rve.) α: Lakeside, Cape Flats.
- G. T. "ventricosa" γ: Seekoe Vlei, Cape Flats.
- H. T. tristis (Morel.): "South Africa."
- J. T. rogersi (Conn.): Stinkfontein, Little Namaqualand.
- K. T. differens Conn.: Walker Bay.
- L. T. cawstoni Conn.: Kokstad, Griqualand East.
- M. T. natalensis Conn.: Lower Umkomaas, Natal.



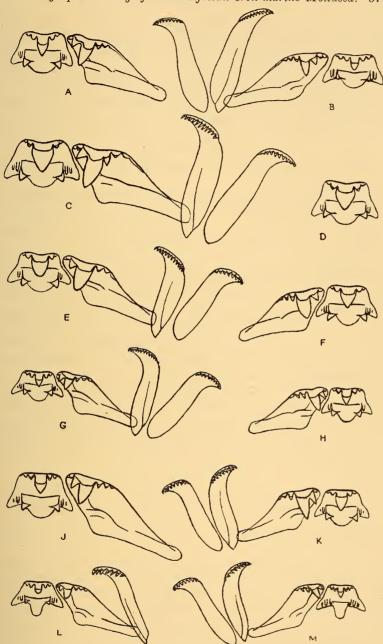
Text-fig. 47.—Shells of Tomichia.

 $H.\ Watson,\ del.$ 

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[To face p. 576.





Text-fig. 48.—Radulae of Tomichia.

the whorls enlarge rather rapidly, as in that illustrated in text-fig. 47, F, but some specimens are considerably narrower, as in that shown in text-fig. 49, and here regarded as typical of the species. The radula suggests that this form may possibly be ancestral to *T. producta*, although the teeth are less specialised.

"Other forms were found in company with this at Lakeside, but their radulae are as yet unknown."

# $\beta$ (text-fig. 47, G).

1914. Tomichia ventricosa Rve. (pars), Thiele, D. Südpol. Expn., xvi, p. 100, f. 1a.  $\,F$ .

1927. Tomichia ventricosa Rve., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 225. R.

Hab. CAPE PENINSULA. Lange Vlei, Retreat, Cape Flats (Connolly; D. Südpol. Expn.).

"Unfortunately we have not been able to examine the radula of this form, but according to Pilsbry and Bequaert, who described that of a specimen from Retreat, it is remarkable in having the

following formula of the denticles: 12, 6, 8,  $\frac{5}{11}$ , 8, 6, 12. This formula, however, is so unlike that of any other species of the genus

formula, however, is so unlike that of any other species of the genus that, assuming it is correct, it seems possible that the radula examined may have been somewhat abnormal.

"The shell has all the characters of a true *Tomichia*; it is larger and more coarsely sculptured than the last form from Lakeside, with a rather long, tapering spire and somewhat flattened whorls. The upper post-embryonic whorls are usually dark red, in contrast to the later, which are pale buff. Only the apical whorls tend to be decollate."

Hab. CAPE PROVINCE. Seekoe Vlei (Connolly) and Strandfontein, Cape Flats (Rogers).

"Radula of three specimens from Seekoe Vlei, with nearly 80 rows of teeth. Formula of denticles: 8-10, 10-12, 6-7,  $\frac{5}{2-3}$ , 5-6,

10-13, 8-10. Teeth rather small; central relatively short; mesocones of central and lateral teeth smaller than in most species of this group. In two of the specimens examined the teeth towards the hinder end of the radula were somewhat smaller than those towards the front end, a very unusual feature.

"The shell resembles that of the last form in general shape and colour, but is thicker and smaller, the last whorl usually more rounded, and the outer lip more sinuous in profile when fully developed. Specimens from a peaty bed near high-water mark at Strandfontein are slightly larger than those from Seekoe Vlei, and in them the transition from the flattened whorls of most of the spire to the rounded last whorl is usually abrupt and marked by a varix, probably indicating a change in environmental conditions."

## $\delta$ (text-figs. 47, C; 48, B).

Hab. CAPE PENINSULA. Wild Bird Vlei, Noordhoek (Barnard). "Radula of specimens from Wild Bird Vlei, with about 80 rows

of teeth. Formula of denticles: 9-10, 11-13, 7,  $\frac{5-7}{3}$ , 6-7, 10-13,

9-10. The central tooth is shorter than usual; the mesocones of the central and laterals are relatively small, and the basal denticles of the central do not differ from one another in size to nearly the usual extent, the first denticle being only very slightly larger than the second—a feature found in all the five specimens examined, and in none of the other forms of *Tomichia* from the Cape.

"The shell is chestnut-brown, rather thin, with rounded whorls, a deep suture, and a decollate spire. It thus differs considerably from the last two forms, but is intermediate in character between the Riet Vlei form and the less attenuated specimens of *T. producta*, and might have been thought to provide a link between these two forms, were it not that it differs so widely in its radula from both of them."

 $\epsilon$  (text-fig. 47, B (profile of outer lip only)).

Hab. CAPE PROVINCE. Port Elizabeth (Crawford; Farquhar). "Radula of two specimens from Port Elizabeth, with 81-85 rows

of teeth. Formula of denticles: 7, 8-9, 6,  $\frac{5}{22}$ , 6, 8-9, 7. In addition

to having fewer and coarser denticles than usual on both the inner and outer marginals, this form differs from the other members of the genus in that the mesocones of the central, and to a less extent of the laterals, point obliquely upwards instead of more directly backwards.

"The shell is not unlike the following form from Riet Vlei, but differs from it in being more strongly striate, in the last whorl and aperture being usually more rounded, and in the outer lip, when fully developed, being more sinuous when viewed in profile; it is usually rather strongly decollate.

"A broader, more ventricose form, with a less sinuous outer lip, occurs at Strandfontein, Cape Flats, but its radula is unknown."

# $\zeta$ (text-figs. 47, A; 48, A).

Hab. CAPE PROVINCE. Riet Vlei, near Milnerton, north of Cape Town (Connolly).

"Radula of 6 specimens from Riet Vlei, with about 40-63 rows of teeth. Formula of denticles: 8-9, 10-11, 5-6,  $\frac{5}{2-3}$ , 5-6, 10-11,

8-9. Mesocones of central and lateral teeth rather long and pointed; first basal denticles of the central very much larger than the small and narrow outer denticles.

"Notwithstanding the difference in the radula, both in respect of the character of the teeth and the smaller number of rows, this form somewhat resembles the two last in its shell; but it usually differs from that found in Wild Bird Vlei in that the whorls expand rather more rapidly and the suture is seldom as deep, while its differences from the Port Elizabeth form have been mentioned above. From elongate specimens of ventricosa from Lakeside the shell of this form usually differs in being of a deeper colour, in the sculpture being slightly coarser and more irregular, in the lower part of the inner lip curving out more to the left, and in the whorls of the spire enlarging less rapidly. It also often grows to a somewhat larger size, and is frequently varicose. Adult specimens are usually strongly decollate.

"This is not improbably one of the commonest and most widely distributed of the forms to which the name ventricosa (Rve.) has usually been applied. Specimens recently collected near the mouth of the Jackals River, on the west coast between Graafwater and Lambert's Bay, probably belong to a narrow variety of this form; but whether this is also true of the rather slender shells that Chaper named Hydrobia caledonensis is still uncertain." These were found in a half-dried pool of water several metres long, not far from Caledon on the road from Swellendam, and were considered by Ancey to be identical with T. ventricosa.

# Tomichia lirata (Turton). (Text-fig. 47, J, and pl. xv, f. 32-33.) Ref. List No. 563.

The shell figured, from Kuils River, is small, short turriform, narrowly rimate, smooth, dull, translucent, corneous brown. Spire produced, sides straight, apex very narrowly rounded. Whorls remaining  $4\frac{1}{2}$  (out of  $5\frac{1}{2}$ ), little convex, gradually increasing, bearing after the apical extremely weak, nearly straight, vertical microscopic striolae; suture shallow. Aperture acuminate ovate, peristome simple, outer lip in profile as in genus, but straighter than usual, columella concave, margin prolonged across paries in a white callus.

Long. 5.9, lat. 2.8; apert. alt. 2.2, lat. 1.4; last whorl 3.6 mm.

Hab. CAPE PROVINCE. Port Alfred (type, Turton); Walmer, near Port Elizabeth (Crawford); Kuils River (Barnard) and Seekoe Vlei, Cape Flats (Connolly).

Type in University Museum, Oxford.

The unique type is a bleached, beach-rolled shell, which derived its name from the presence on the last 2 whorls of 5 spiral chords, nearly obliterated by weathering, such as are by no means unusual in the genus.

"Radula of 8 specimens from Kuils River, with about 60-75 rows of teeth. Formula of denticles: 8-9, 10-11, 6-7,  $\frac{5}{2-3}$ , 6-7, 10-11, 8-9. The teeth are intermediate in form between those of

10-11, 8-9. The teeth are intermediate in form between those of ventricosa (text-fig. 48, F) and the Seekoe Vlei form (text-fig. 48, G), those towards the front of the radula being usually nearer the latter type, while in the hinder rows of the specimens examined the teeth were rather larger, with broader mesocones in the centrals, thus somewhat approaching the type found in the former species. This difference was apparent even in adult specimens, though it may not be always present.

"Fully grown shells, with thickened peristomes, are usually decollate, but in the majority of specimens examined the lip was thin and the apex entire, although the animals were sexually mature. As a rule the spire is shorter than in the preceding forms and the whorls are not so much rounded, but some specimens are more elongated, with a deeper suture, although they have similar radulae to the others. This variation in the form of the shell is not sexual, as nearly all the specimens examined proved to be male, whether the shells were broad or narrow.

"This species clearly belongs to the typical group of Tomichia and is far removed from Assiminea, in which it was originally

placed; it is probably the form that Krauss named T. ventricosa var. brevis, judging from his figures and brief description, but no specimens so named by him have been traced."

Tomichia tristis (Morel.). (Text-figs. 47, K; 48, H.) Ref. List No. 560.

1889.  $Hydrobia\ tristis$  Morel., J. de C., xxxvii, p. 18, pl. ii, f. 4. D.F.

Shell small, rather narrowly rimate, moderately solid, smooth, glossy, bright corneous brown. Spire moderately produced, sides straight, apex very narrowly rounded. Whorls 6, moderately convex, regularly increasing, first smooth, remainder bearing very weak, nearly straight and vertical growth striolae; suture simple, well defined. Aperture acuminate oval, peristome simple, almost continuous, columella concave, inclined to the right, upper margin scarcely reflexed; operculum as in genus. The type, a slightly over-slimmed example, measures Long. 6·0, lat. 2·7; last whorl 3·2 mm.

Hab. CAPE PROVINCE. Port Elizabeth (type, Crawford). Type in British Museum.

"Radula of a specimen closely resembling the type, with about 56 rows of teeth (text-fig. 48, H). Formula of denticles: 9, 9-10, 6,

 $\frac{5}{2}$ , 6, 9-10, 9, the number of denticles of the inner and outer

marginal teeth being more nearly equal than in any of the preceding forms. The mesocone of the central is rather narrow. The shell is rather like that of the last species, but can be distinguished from it by its rounder whorls and aperture, and in its surface being usually more glossy; it is not often decollate."

Tomichia rogersi (Conn.). (Text-figs. 47, L; 48, J.)

1929. *Hydrobia rogersi* Conn., Ann. Natal Mus., vi, p. 242, pl. xiv, f. 41. D.F.R.

Shell small, acuminate, hardly subrimate, rather dull, translucent, rather dark brown. Spire somewhat produced, sides regular, apex subacute. Whorls 6, regularly increasing, 2nd, 3rd and 4th convex, later less so, whole surface typically malleate and the last 4 or  $4\frac{1}{2}$  whorls sculptured with coarse, rather distant vertical costulae, interspersed with fine microscopic parallel striolae; suture simple, canaliculate. Aperture acuminate ovate, labrum vertical and nearly straight in profile; columella weak, concave, margin extremely narrowly reflexed, scarcely forming a rima, and prolonged across paries in a callus, sometimes so thick as to render the peristome almost continuous; operculum very thin, paucispiral.

Long. 6·1, lat. 3·1; apert. alt. 2·0, lat. 1·3; last whorl 3·9 mm.

Hab. LITTLE NAMAQUALAND. Stinkfontein (type, Rogers); Lekkersing (Lawrence).

Type in South African Museum.

The shell is larger and comparatively more slender than the foregoing, with more rapidly increasing whorls. "Radula of specimens from Stinkfontein with about 65 rows of teeth (text-fig. 48, J).

Formula of denticles: 10-11, 11-12, 6-7,  $\frac{5-7}{3}$ , 6-7, 11-13, 10-11.

The teeth are slightly larger than usual, the marginals attaining a length of .08 mm., which is longer than that of any other species examined, although the shells yielding these radulae were only about 6 mm. in height.

"The shell is characterised by the oval contour of the whorls, the strong vertical striae, although the shell is not thick, and the dull brown colour, contrasting with the brighter reddish brown of most of the allied species. The spire is seldom decollate to any great extent.

"A form intermediate between this species and T. lirata in some features of the shell and radula, but attaining a larger size than either, has recently been found plentifully near the mouth of the Jackals River, between Graafwater and Lamberts Bay, in the same locality as the slender, decollate, glossy form mentioned under 'ventricosa,  $\zeta$ ,' but quite distinct from it."

# Tomichia differens sp. n. (Text-figs. 47, M; 48, K.)

Shell very small, scarcely rimate, acuminate ovate, smooth and glossy, fairly solid, corneous brown. Spire somewhat produced, sides straight and regular, apex narrowly rounded. Whorls 5, little convex, regularly increasing, first 2 smooth, remainder sculptured with rather strong, straight, somewhat oblique microscopic striolae; suture simple, shallow. Aperture acuminate ovate, outer lip straight and somewhat oblique in profile, columella concave, margin practically simple, rimation practically none.

Long. 4.4, lat. 2.6; last whorl 2.6 mm.

Hab. CAPE PROVINCE. Freshwater stream flowing out of limestone cave "Die Kelders" on coast of Walker Bay, about 10 miles south of Stanford (type); Kuils River, Cape Flats (Barnard).

Type in South African Museum.

"Radula of three specimens from Walker Bay, with about 70 rows of teeth. Formula of denticles: 8-9, 9-10, 7,  $\frac{5}{2-3}$ , 7, 9, 9. In a

young specimen from Kuils River with 60 rows of teeth the formula is 8, 10, 7,  $\frac{5}{3}$ , 7, 10, 8, but usually this form seems to resemble

tristis in that the inner and outer marginal teeth show little difference in the number of their denticles. The mesocone of the central is large and broad, though its length varies in different specimens.

"The small, rather compact shell has the outer lip oblique and straight in profile, even when fully developed, whereas in all the other species of *Tomichia* it is approximately vertical and more or less curved. The rather short spire is not decollate in any of the specimens examined; most of the shells are translucent corneous brown, but among 30 from Walker Bay one shell in good condition is white."

Tomichia ? alabastrina (Morel.).

(Text-fig. 50.)

Ref. List No. 559.

1889. *Hydrobia alabastrina* Morel., J. de C., xxxvii, p. 19, pl. ii, f. 5. D.F.

Shell very small, acuminate ovate, rimate, type white and beach-rolled smooth. Sides of spire regular, apex subacute. Whorls 6, little convex, remains of sculpture showing a few faint vertical growth striolae; suture well defined. Aperture acuminate ovate, peristome simple, columella short, concave, margin scarcely reflexed, leaving a narrow rima; operculum unknown.

Long. 3.8, lat. 2.7; last whorl 2.4 mm.

Hab. CAPE PROVINCE. Port Elizabeth (type, Crawford). Drift sand, Seekoe Vlei (Connolly).

Type in British Museum.

Morelet remarks that this species varies in degree of perforation



Text-fig. 50.— $Tomichia\ alabastrina\ (Morel.).$  Type set in British Museum;  $\times 7$ . Type on left.

and length of spire, irrespective of number of whorls, but remains constant in smoothness, relative solidity of shell and glossy white

colour. The variability he stresses is realisable on a casual glance at his type set of three specimens figured above, each of which possibly represents an entirely distinct species, but fortunately there is no doubt as to the largest being his actual type, and in default of fuller acquaintance with this ill-determined species it may be as well to leave it as a very doubtful member of the genus under present notice.

## "(ii) Species from Natal and East Griqualand.

"Central tooth of radula with the median continuation of the base longer than broad; inner marginals usually with fewer denticles than the outer marginals. The shell is dull, rather thick, and more compact than in most members of the first group, with a markedly sinuous outer lip.

"In contrast to the preceding, this group is at present only known to contain two very distinct and well-defined species."

Tomichia cawstoni sp. n. (Text-figs. 47, N; 48, L.)

Shell very small, acuminate ovate, imperforate, rather solid, smooth, dull, translucent. Spire produced, sides straight, apex, when present, acute. Whorls 6, nearly flat, regularly increasing, not angled at periphery, sculpture consisting of extremely faint, practically straight and vertical growth striolae; suture very shallow. Aperture acuminate subovate, outer margin more convex than inner, peristome simple, continuous, outer lip curving forward towards base, columella glossy, slightly concave, inclined inwards and extending across paries in a thick callus. Operculum thin, corneous, paucispiral, nucleus near left lower margin.

Long. 4.0, lat. 2.3; apert. alt. 1.6, lat. 1.2; last whorl 2.8 mm.

Hab. CAPE PROVINCE. Kokstad (Cawston).

Type in British Museum.

"Radula with about 65–75 rows of teeth (text-fig. 48, L). Formula of denticles: 10–11, 7–8, 6–7,  $\frac{5}{3}$ , 6–7, 7–8, 10–11. Mesocones of

central and lateral teeth rather small and blunt; denticles of inner marginal relatively fewer, and continuation of base of central longer and narrower than in any of the preceding species.

"The shell can be easily recognised by its flattened whorls and very shallow suture; the spire is usually eroded and decollate. Most of the shells are dull yellowish green, but a few appear to be unpigmented, of a pale grey colour."

Tomichia natalensis sp. n. (Text-figs. 47, O; 48, M.) Ref. List No. 560 (pars).

1927. Paludestrina tristis Morel., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 222. N.R.

Shell small, conic ovate, scarcely rimate, dull, smooth, translucent, corneous yellow-brown. Spire produced, sides straight, apex narrowly rounded. Whorls 6, little convex, regularly increasing, first 2 smooth and glossy, remainder showing, under a lens, extremely faint, nearly straight vertical striolae; suture moderate. Aperture acuminate oval, peristome simple, outer lip sinuous, columella concave, inclined upwards to right, margin practically adnate, prolonged across paries in a thin white callus.

Long. 5.55, lat. 2.75; apert. alt. 1.85, lat. 1.5; last whorl 3.35 mm.

Hab. NATAL. Lower Umkomaas (type) and Winkel Spruit (Burnup).

Type in British Museum.

"Radula of specimens from Lr. Umkomaas with between 60 and 80 rows of teeth (text-fig. 48, M). Formula of denticles: 8-10, 8-9, 6,  $\frac{5-7}{3}$ , 6, 8-9, 8-10. Mesocones of central and lateral teeth

relatively small and narrow; basal denticles of central arranged in an oblique row on each side, the small outermost denticles being the farthest back. In this last feature the radula of the present species differs from those of all other members of the genus, but in the form of the basal plate of the central tooth, and in all other important characters, it agrees sufficiently closely with that of the last species to suggest that these two forms are rather nearly related.

"The shell can be distinguished from that of cawstoni by its more rounded whorls, deeper sutures, buff colour, and larger size. Its colour and dull surface, the somewhat shouldered form of the last whorl, and the more sinuous outer lip separate it from tristis, a species with which it has hitherto been confused, though it is not even closely related to it. The spire is seldom much decollated. Under the microscope the surface of well-preserved specimens is seen to be covered with very fine and close spiral striae."

#### FAMILY ASSIMINEIDAE.

Shell usually ovate with somewhat flattened whorls, rarely exceeding 10 mm. in length; operculum corneous, paucispiral. Snout and foot short, sole undivided, eyes at or near ends of tentacles; mantle

cavity without gill, with osphradium on its left side; cerebral ganglia connected by a short, broad commissure, pedal ganglia with strong anterior and weaker posterior commissure: otocysts always containing a fairly small otolith. Penis arising from top of neck. Jaw rudimentary; radula fairly long, central tooth somewhat quadrate, admedian with an accessory plate on the outer side of its base, outer marginal rather broad, multicuspid. Habit amphibious and usually found in brackish water.

> Genus Assiminea Fleming, 1828 (Hist. Brit. Anim., p. 275). Type A. grayana Fleming.

Central tooth typically with basal cusps, inner marginals with large cusps, outer marginals broad with numerous small cusps, but in all South African species yet examined there are no basal cusps or denticulations on sides of central teeth. Operculum corneous, paucispiral, nucleus basal.

With two exceptions, all South African forms of this genus are unicoloured, ovate, much the same size and contour and hence extremely difficult to differentiate. As bifasciata is not only the commonest, but most easily recognisable by reason of its coloured bands, it is obviously convenient to place it first on the list and endeavour to explain by what features it may be possible to identify those which follow.

> Assiminea bifasciata G. Nevill. (Text-figs. 51, A; 52.) Ref. List No. 564.

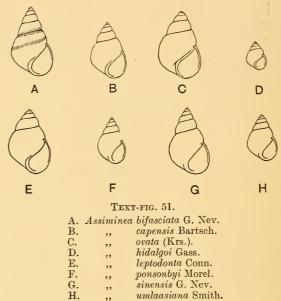
1880. Assiminia bifasciata Nev., J. Asiat. Soc. Bengal, xlix, 2, p. 162. D.

1925. Assiminea bifasciata Nev., Conn., Trans. R. Soc. S. Africa, xii, p. 210. N.R.

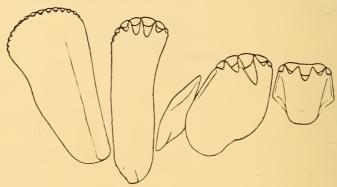
1932. Assiminea bifasciata Nev., Turton, Marine Shells of Port Alfred, p. 153. N.

Shell of average size, imperforate, conic ovate, solid, rather dull, smooth, buff with two rather indistinct dull chestnut bands, one below the suture and one round the periphery, and basal area usually the same colour. Spire moderately produced, sides straight, apex acute. Whorls 7, regularly increasing, nearly flat, rounded or most inconspicuously angulate at periphery, practically sculptureless, the close weak growth lines hardly visible except under a microscope; suture shallow. Aperture acuminate ovate, peristome simple, acute, labrum straight and nearly vertical in profile, columella erect, concave, slightly thickened upward but not reflexed. Operculum as in genus.

Alt. 6.0, lat. 3.4; apert. alt. 2.8, lat. 1.4; last whorl 4.0 mm.



All figures thrice natural size.



Text-fig. 52.—Assiminea bifasciata G. Nev., Isipingo. Teeth from radula; ×600.

Hab. NATAL. Port Natal (type, Nevill); Umhlatusani; Umlaas and Umkomaas Rivers (Burnup); Ingani; Isipingo; Scottburgh; Umgeni Lagoon (Cawston); Durban (Puzey).

CAPE PROVINCE. East London (Kincaid); Kowie (Bull); Port Alfred (Turton).

LORENZO MARQUES. Estuary of Komati River (Junod).

Type in Calcutta Museum.

Radula about 1.35 mm. long, with 58 rows of teeth; central with 5 cusps, first lateral larger than central, also with 5 cusps; then comes a small tooth, without any distinct cusps, as in other members of the genus, third tooth with about 7 cusps and long, rather narrow basal plate; last teeth bearing 14 or 15 small denticles.

# Assiminea ovata (Krs.). (Pl. xv, f. 37, and text-fig. 51, C.) Ref. List No. 568.

1848. Paludina ovata Krs., Südafr. Moll., p. 85, pl. v, f. 16. D.F.

1915. Assiminea ,, ,, Bartsch, Bull. U.S. Nat. Mus., xci, p. 135. L.

1927. Assiminea ovata Krs., Thiele, Zool. Jahrb., liii, p. 132, f. 13.  $\,R.$ 

1932. Assiminea ovata Krs., Turton, Marine Shells of Port Alfred, p. 153. N.

Shell comparatively large, acuminate ovate, practically imperforate, reddish brown, rarely, fide Krauss, with 1 or 2 obscure brown bands. Whorls 6, nearly flat, the last convex, rounded at base. Aperture ovate, columella erect, concave, margin adnately reflexed. The paratype figured measures

Alt. 6.2, lat. 3.4; apert. alt. 2.7, lat. 1.3; last whorl 4.6 mm.

Hab. CAPE PROVINCE. Knysna and Zoetendals Valleys (type, Krauss); Port Elizabeth (Crawford); Buffalo R., East London (Mrs Longstaff); Port Alfred (Turton); Bushman R., Albany Division (Hewitt).

NATAL. Mouth of Umgeni River (Burnup).

Type in Stuttgart Museum.

Radula of a specimen from Durban somewhat similar to that of the preceding species, but the last tooth in each row has only about ten denticles and the tooth before about five.

A broader form than bifasciata; I have not seen a banded example.

# Assiminea capensis Bartsch. (Text-fig. 51, B.)

1915. Assiminea capensis Bartsch, Bull. U.S. Nat. Mus., xci, p. 135, pl. vi, f. 9. D.F.

1932. Assiminea capensis Bartsch, Turton, Marine Shells of Port Alfred, p. 153. N.

Shell broadly conic, imperforate, lightish brown. Spire regular, apex noticeably blunter than in other South African forms. Whorls 5, moderately convex, sculpture extremely weak. Aperture acuminate ovate, columella short, white, concave, callus continuous. The type measures

Alt. 6.0, lat. 3.5; apert. alt. 2.8, lat. 2.4; last whorl 4.3 mm.

Hab. CAPE PROVINCE. Port Alfred (type, Turton). Type in U.S. National Museum.

Assiminea sinensis G. Nevill.

(Text-fig. 51, G.) Ref. List No. 570.

1880. Assiminia sinensis Nev., J. Asiatic Soc. Bengal, xlix, 2, p. 161. D.

1887. Assiminea sinica Nev. (for sinensis Nev., non chinensis Pfr.), Bttg., Jahrb. D. Mal. Ges., xiv, p. 203. D.

1932. Assiminea sinensis Nev., Turton, Marine Shells of Port Alfred, p. 153. N.

The comparatively large Natalian form ascribed to this species is barely subrimate, acuminate ovate, pale brown; sides of spire straight and regular, apex acute. Whorls 7, moderately convex, striation extremely weak; suture well defined. Aperture short, well rounded at base, columella short, concave, upper margin almost or entirely adnate, usually obliterating the minute rima.

Alt. 5.9, lat. 3.5; apert. alt. 2.5, lat. 1.9; last whorl 4.0 mm.

Hab. NATAL. Widenham; Umkomaas (Burnup); Isipingo (Cawston).

CAPE PROVINCE. Port Alfred (Turton).

Type in Calcutta Museum.

Somewhat resembles *bifasciata*, but has no bands; radula rather like that of A. ovata.

Described from Hong Kong, its recent occurrence on Nias I., near Sumatra, helps to bridge the gap between China and the Cape.

 $Assimine a\ ponson by i\ {\bf Morel}.$ 

(Text-fig. 51, F.)

Ref. List No. 569.

1889. Assiminea ponsonbyi Bttg. in litt., Morel., J. de C., xxxvii, p. 17, pl. ii, f. 6. D.F.

A very small imperforate form, darker brown than most of its confrères. Sides of spire regular, hardly convex, apex acute. Whorls 6, little convex, sculpture

extremely weak, suture shallow. Aperture slightly narrower in comparison than in most S. African species, columella very short, concave, strongly thickened upwards without any marginal reflexion.

Alt. 3.9, lat. 2.4; apert. alt. 1.75, lat. 1.1; last whorl 2.7 mm.

Hab. CAPE PROVINCE. Rufane Vale, Port Elizabeth (type, Crawford).

Type in British Museum.

Apparently a rare species and generally misunderstood owing to Tomichia tristis (Morel.) having been widely distributed under its name.

Assiminea hidalgoi (Gassies).

(Text-fig. 51, D.)

Ref. List No. 566.

1869. Hydrocena hidalgoi Gass., J. de C., xvii, p. 78. D.

1932. Assiminea granum Morel., Turton, Marine Shells of Port Alfred, pp. 154, 294. N.

The smallest true South African species, broadly acuminate ovate, subrimate, corneous brown. Whorls 4, convex, with moderately strong and regular growth lines; suture well defined. Aperture short acuminate ovate, columella short, concave, callus, when present, faint.

Alt. 2.5, lat. 1.6; apert. alt. 1.2, lat. 0.9; last whorl 1.6 mm.

Hab. NATAL. Amahlongwana Lagoon (Burnup).

CAPE PROVINCE. East London (Kincaid); Port Alfred (Turton).

Described from New Caledonia. Type in British Museum.

The type set of A. granum Morelet includes a specimen of hidalgoi, which may explain why Morelet himself in 1883 considered the two species identical, but they are clearly distinct, granum having a rather more slender contour than the present species.

Assiminea umlaasiana Smith.

(Text-fig. 51, H.) Ref. List No. 571.

1902. Assiminia umlaasiana Smith, J. of C., x, p. 248, pl. iv, f. 3. D.F.

1932. Assiminea umlaasiana Smith, Turton, Marine Shells of Port Alfred, p. 153. N.

A small, well-defined species with longer spire than the two preceding. Imperforate, pale brown, with 6 moderately convex whorls, sculptured with extremely close, fine, transverse microscopic striae.

Alt. 4.0, lat. 2.8; apert. alt. 1.7, lat. 1.2; last whorl 2.75 mm.

Hab. NATAL. Isipingo (type, Burnup).

CAPE PROVINCE. Still Bay (Stephenson); Jeffreys Bay (Miss Winslow); Port Alfred (Turton).

Type in British Museum.

## Assiminea leptodonta Conn.

(Text-fig. 51, E.)

1922. Assiminia leptodonta Conn., A.M.N.H., x, p. 122. D. 1925. Assiminea ,, Trans. R. Soc. S. Africa, xii, p. 211, pl. iv, f. 31. F.R.

Shell small, broadly ovate, imperforate, darkish brown. Sides of spire straight, apex acute. Whorls 6, almost flat above but well rounded at periphery, sculptured after the first  $1\frac{1}{2}$  with very faint, straight striae, crossed by extremely fine, close microspiral lines; suture nearly flat. Aperture subovate, somewhat flattened at base, columella white, slightly concave, margin narrowly adnate, callus white and thin.

Alt. 5·2, lat. 3·4; apert. alt. 3·0, lat. 2·0; last whorl 4·2 mm.

Hab. LORENZO MARQUES. Estuary of Komati R., Rikatla (Junod).

Type in British Museum.

The delicate radula differs so much from the usual type found in Assiminea that it is probable that this species belongs to a distinct genus, perhaps Paludinella; but the true affinities of the following species are also very doubtful, and I prefer for the present to leave them all in Assiminea, sensu lato.

On or near the south-west coast of Africa are a number of raised deposits of uncertain age, often containing enormous assemblies of minute semi-fossilised shells, of entirely different origin in different, but near-by localities. The sand-dunes are full for the most part of weathered land shells, notably Trachycystis and Fauxulus capensis, while round some of the inland vleis the sandy shore often affords depository for yet another kind of molluscan assemblage. Thus, in the Cape Peninsula and its immediate precincts I may instance the raised beach at Green Point, with its subfossil sea-shells, and a deposit at Milnerton, but little to its north, where there is predominance of brackish or freshwater operculates; the sand-dunes of Hout Bay and drift sand about Kalk Bay contain little but weathered specimens of the land species still living in their neighbourhood, but the drift sand at Seekoe Vlei, which I take to be very near the old "Baszaarms Kraal," combines a mixture of small marine shells, such as Nassarius

kraussianus (Dkr.) and small pelecypods, with Tomichia, Succinea, Bulinus and numbers of small operculates of various genera, usually too weathered and too few of each to admit of exact determination.\*

It is unfortunate that more than one author appears to have been misled into regarding the whiteness and transparency of specimens from these subfossil deposits as features of specific value and used them for the foundations of new species, as did Krauss in regard to the two which follow.

> Assiminea knysnaensis (Krs.). (Pl. xv, f. 34, and Pl. xvi, f. 29.) Ref. List No. 567.

1848. Paludina knysnaensis Krs., Südafr. Moll., p. 86, pl. v, f. 17. D.F.

1932. Assiminea knysnaensis Krs., Turton, Marine Shells of Port Alfred, p. 153.

The tube which conceals the type contains about 20 little shells and at least three distinct species, none of which is in exact accordance with the original description and figure and only one is reconcilable thereto, so that it must be adopted as the type and is so treated hereunder. Shell very small, acuminate ovate, umbilicate, thin, smooth, rather dull, pale olivaceous, probably by bleaching. Spire produced, apex narrowly rounded. Whorls 5, convex, regularly increasing, the later bearing almost obsolete straight vertical growth lines; suture well defined. Aperture subovate, peristome simple, acute, labrum straight and vertical in profile, columella erect, concave, margin moderately reflexed, half covering the narrow umbilicus.

Alt. 3.2, lat. 1.6; last whorl 1.9 mm.

Hab. CAPE PROVINCE. Knysna and Zoetendals Valleys (type, Krauss); marshy ground near the beach, Port Elizabeth (fide Crawford); Port Alfred (fide Turton); Kabeljaauws, Bathurst Division (Hewitt).

Type in Stuttgart Museum.

The above dimensions are considerably smaller than those given by Krauss, who evidently regarded the entire content of the tube as conspecific and may have based his description on the freshest and his measurement on one of the largest shells; he emphasises the point, however, that the aperture is very little pointed above and scarcely one-third of total length of shell, which is the case in the figure on Plate xv.

<sup>\*</sup> For full treatment of the Cape Flat deposits, see pp. 42-54, 59 of Haughton's paper "Geol. Cape Town and adjoining Country. Explanation of Sheet No. 247" (Geol. Surv. Pretoria, 1933).

Assiminea fasciata (Krs.).

(Pl. xv, f. 35-36.)

Ref. List No. 565.

1848. Paludina fasciata Krs., Südafr. Moll., p. 86, pl. v, f. 18. D.F.

Shell very small, acuminate ovate, rimate, smooth, corneous buff, with traces of 3 faint rufous bands. 5 convex whorls, later bearing extremely weak vertical growth lines; suture deep. Aperture acuminate ovate, peristome thick, columella concave, margin barely reflexed, not nearing the narrow rima.

Long. 3.0, lat. 1.7 mm.

Hab. CAPE PROVINCE. Knysna and Zoetendals Valleys (Krauss); Port Alfred (in error, Turton).

Type in Stuttgart Museum.

Only 1 shell, obviously the type, in the type tube shows very faint traces of the bands mentioned by Krauss, and the majority belong to another species, which was treated as *fasciata* by Turton in 1932 and is described hereunder.

Assiminea globulus sp.n.

(Text-fig. 53.)

1932. Assiminea fasciata Krs., Turton, Marine Shells of Port Alfred, p. 153, pl. xxxv, f. 1094. D.F.

Shell very small, ovate globose, imperforate, smooth, normally greyish buff or brown, but bleached in type. Spire short, sides regular, apex acute. Whorls 5,



Text-fig. 53.—Assiminea globulus Conn. Type on left;  $\times 2$ .

convex, rapidly increasing, sculptured with close, fine, faint, straight, nearly vertical growth striolae; suture well defined. Aperture acuminate ovate, labrum straight and nearly vertical in profile, columella concave, thickened upwards without reflexion; operculum corneous, paucispiral, nucleus a little to left of median line, about ½ of length from its base.

Alt. 3·4, lat. 3·0; last whorl 3·1 mm.

Hab. CAPE PROVINCE. Lacus-

trine deposit, Milnerton (type), Seekoe Vlei (Connolly), and Knysna and Zoetendals Valleys (subfossil, Krauss); Port Alfred (Turton).

Type in British Museum.

Many specimens, as in the type, develop a thick white callus across the paries and in some the later whorls are somewhat gradate, or shouldered at the periphery. Although I have not yet seen fullgrown examples in other but fossil condition, very young specimens from Port Alfred, kindly furnished by Colonel Turton, prove that this species is not, as might otherwise be presumed, extinct; its small size, short spire and extreme obesity of body whorl distinguish it from all allied species.

## Assiminea isosceles sp.n.

(Text-fig. 54.)

Shell very small, conoid, rimate, smooth, bleached white. Spire produced, sides flat, straight and regular, apex acute. Whorls 5, regularly increasing, flat, usually with trace of extremely blunt peripheral angulation, remaining sculpture consisting of faint, nearly straight, vertical growth lines; suture very shallow. Aperture ovate, little acuminate, labrum straight and nearly vertical in profile, columella concave, upper margin narrowly reflexed, little obscuring the rima; operculum unknown.

Alt. 5·1, lat. 2·7; last whorl 3·2 mm.

Hab. CAPE PROVINCE. Lacustrine deposit, Milnerton (type, fossil, Connolly).

Type in British Museum.

More than 30 specimens, all apparently conspecific, though differing a little in degree of peripheral angulation and continuity of peri-



Text-fig. 54.—Assiminea isosceles Conn. Type on left; ×2.

stome, which in many examples extends across the paries and in a few is entirely free, though never thickened or reflexed. The largest shell, with nearly 6 whorls, is 6·3 mm. in length, but appears to be of abnormal growth, all others being about same size as type. The practically flat whorls and sides of spire and conspicuous rimation combine to distinguish this fossil from its South African relations, in most of which the whorls are convex or the shell imperforate.

I would not have ventured to publish these two ill-conditioned species, were it not for Tomlin's very kind advice and assurance that to the best of his belief they do not belong to the marine fauna and that, with so large series before me, it may be preferable to do so lest further confusion arise on the discovery elsewhere of shorter series than my own.

# Assiminea (?) lugubris Turton. (Text-fig. 55.)

1932. Assiminea lugubris Turton, Marine Shells of Port Alfred, p. 154, pl. xxxv, f. 1095. D.F.



TEXT-FIG. 55.
Assiminea (?)
lugubris Turton.
Type in Oxford
Museum; ×8.

Shell very small, globose, imperforate, smooth, glossy, corneous brown, columella, except at extreme base, white and glossy. Spire short, sides rounded, apex minute, mamillate. Whorls 3, convex, rapidly increasing, practically sculptureless, suture simple, not deep. Aperture nearly circular, slightly angulate at top, peristome simple, labrum straight and scarcely receding in profile, columella concave, white and glossy until near its extreme base, slightly thickened but not truncate or reflexed. Operculum?

Alt.  $2\cdot 1$ , lat.  $1\cdot 75$ ; apert. alt.  $1\cdot 32$ , lat.  $1\cdot 02$ ; last whorl  $1\cdot 94$  mm.

Hab. CAPE PROVINCE. Port Alfred (Turton). Type in Oxford University Museum.

## Order Aspidobranchia.

Nervous system little concentrated. Pedal centres long ganglionated cords, to anterior ends of which pleural centres are attached; cerebral ganglia widely separated, and united by a long commissure lying in front of buccal mass and salivary glands. An infra-oesophageal commissure is present; osphradium little specialised, situate on branchial nerve; otocyst containing numerous otoconia. Ctenidia nearly always present, bipectinate and free at distal ends. As a rule the Aspidobranchia exhibit well-marked traces of original bilateral symmetry, usually having 2 auricles to the heart.

#### SUBORDER Rhipidoglossa.

Aspidobranchia with dialyneurous nerve system; osphradium single except in genera with 2 ctenidia; 1 or 2 hypobranchial glands. Radula with numerous slender marginal teeth.

#### FAMILY HYDROCENIDAE.

Shell small with exerted spire, operculum with apophysis. No ctenidium, but a pulmonary cavity present; foot obtuse; tentacles short; heart with a single auricle; penis absent; teeth towards centre of radula little developed, outer laterals not capituliform, marginals numerous, imbricating; habitat on land in moist places.

Genus *Hydrocena* Pfr., 1847 (Zeitschr. f. Mal., iv, p. 112).

Type Cyclostoma cattaroensis Pfr.

Shell very small, globosely conic, corneous brown, operculum ovate, paucivolute, furnished with an internal peg (or apophysis).

Hydrocena noticola Bs. (Pl. xvi, f. 28.) Ref. List No. 572.

1856. Hydrocena noticola Bs., A.M.N.H., xviii, p. 439. D.

1897. Assiminea tyttha M. & P., A.M.N.H., xix, p. 639, pl. xvii, f. 11. D.F.

1927. Assiminea noticola M. & P., Thiele, Zool. Jahrb., liii, p. 134. Check List.

Shell minute, acuminate ovate, practically imperforate, thin, smooth, glossy, transparent, corneous brown. Spire not greatly produced, apex mamillate. Whorls  $3\frac{1}{2}$ , rounded, very convex, rapidly increasing, sculptured with extremely weak, close, nearly straight and vertical microscopic striolae, suture deep. Aperture semicircular, peristome simple, base and labrum rounded, but paries oblique and nearly straight, columella short, concave, thickened upwards into a triangular callus.

Alt. 2.2, lat. 1.6 mm.

Operculum oval, articulated, corneous, with concentric whorls, which owing to its extreme thinness and transparency are clearly visible, as in fig. 28, on its internal face, nucleus basal, apophysis on left centre of basal margin.

Hab. CAPE PENINSULA. Table Mountain, Camps Bay (type, Layard); Simonstown; Hout Bay (Connolly).

CAPE PROVINCE. Grahamstown; Kowie; Bathurst; Port Elizabeth (Farquhar); The Gorge, Somerset East (Mrs. Howard); Keurbooms R. bush (Barnard); River Zonder Einde; Deep Walls, Knysna (Mrs. Longstaff); Kokstad (Cawston).

NATAL. Howick (tyttha); Scottburgh; Karkloof; Dargle; Game Pass; Ntimbankulu (Burnup).

ZULULAND. Eshowe (Burnup).

Type of tyttha in British Museum, noticola ubi?.

Radula rhipidoglossate, central teeth so minute as to be seldom discernible.

Thiele (l.c.) placed this species in Assiminea, but its operculum and radula prove it to be a Hydroxena.

#### FAMILY NERITIDAE.

Shell imperforate, usually globose or ovate, with a low or vestigial spire and a flattened columellar lip; operculum calcareous, usually with apophysis. Head large, with a short and broad, divided snout; tentacles long and slender; eyes at the external bases of the tentacles, usually pedunculate; foot short; mantle-cavity containing a triangular ctenidium or gill; heart with two auricles; genital organs complex. Radula with four lateral teeth on each side, of which the second and third are small and the first and fourth much broader, the latter being known as the capituliform tooth, which is believed to have been formed by the union of two teeth, although it has only one very wide cusp, usually denticulate along the edge; marginal teeth slender and numerous, in rows that curve backwards on each side, as in other Rhipidoglossa; the thicker parts of the teeth are usually of a golden brown colour.

This family includes four genera found in South Africa, namely, Smaragdia, Nerita, Neritina, and Septaria, but the first two of these are marine, so do not come within the province of this work. At one time Neritina and Smaragdia were both often confused with Theodoxus, but this is a distinct genus, which is not known to occur in South Africa.

## Subfamily NERITINAE.

Male with a cephalic penis on inner side of right tentacle; female with a reinforcement sac beside the oviduct; radula having a central tooth.

Genus Neritina Lam., 1816. (Enc. Méth. Vers., ii, p. 11, pl. cccclv). Type Nerita pulligera Lin.

Shell globose with a very short, blunt spire; aperture semicircular, outer lip acute, columellar region expansive, flattened, its edge frequently denticulate. Operculum closely fitting aperture, calcareous, paucispiral, with basal nucleus, near which there are usually, on its inner surface, a projecting peg and curved rib, articulating with the columella. Female genital ducts triaulic. First lateral tooth of radula more than twice as broad as long, and somewhat oblique, the outer end being further forward than the inner; marginals 50–100 or more on each side, very slender, with serrate cusps.

This genus is estuarine and fluviatile, the Natal forms being usually found in lagoons of slightly brackish water, often on the mud in the

shade of mangroves. The small species from Congella, Natal, and Port Alfred, which has been identified as *Neritina souverbiana* Gass., appears to be a *Smaragdia*.

#### Neritina natalensis Rve.

#### Ref. List No. 574.

1848. Neritina zebra "Lam.," Krs., Südafr. Moll., p. 88. N.

1855. ,, natalensis Rve., Conch. Icon., pl. xvi, f. 75. D.F.

1922. Theodoxus natalensis Rve., Cawst., S. Afr. J. Sci., xix, p. 277. N.

1925. Theodoxus natalensis Rve., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. F.

1925. Theodoxus natalensis Rve., Cawst., Ann. Trop. Med. Parasit., xix, p. 217, f. 10. F.

1925. Theodoxus natalensis Rve., Conn., Trans. R. Soc. S. Africa, xii, p. 213. L.

1927. Theodoxus natalensis Rve., Cawst., Observation, iii, p. 16. R.
1937. Neritina natalensis Rve., Andrews, J. Morphol., lxi, pp. 530,
532, 535, 540, pl. i, f. 5; pl. ii, f. 10; pl. iv, f. 22; pl. v, f. 34. A.

Shell acuminate ovate, solid, smooth and glossy, buff or yellow with black flames and streaks, or unicoloured dark brown, frequently thickly covered with large or small yellow spots, while occasionally one of these patterns changes abruptly to another on the same shell; interior bluish white. Spire moderately produced, summit obtuse. Whorls 4, the last comprising practically the entire shell, bearing regular, fairly strong growth lines, which are crossed and divided into minute points by extremely close, fine, regular, microspiral lines. Aperture acuminate subovate, columella plain or minutely denticulate, operculum iron-grey, outer margin flesh. Two Umgeni shells of moderate size but with complete spires measure

Alt. 17·3, lat. 13·4; apert. alt. 12·2, lat.  $6\cdot0$ ; last whorl 16·6 mm., and ,  $20\cdot0$  ,  $14\cdot5$ ; ,  $13\cdot5$  ,  $6\cdot0$ ; ,  $18\cdot6$  mm.

Hab. NATAL. Umgeni R. (type, Krauss); Illovo, Umgeni, Tongaat, Umkomaas and Umbogintwini lagoons (Cawston); Nonoti; Umzimkulu (Burnup); Ifafa (Akerman).

LORENZO MARQUES. Inhambane; Tette (Peters); Delagoa Bay; Estuary of Komati R., Rikatla (Junod).

Type set in British Museum.

Also known from several localities up the east coast of the continent.

## Neritina gagates Lam.

1822. Neritina gagates Lam., Hist. An. s. Vert., Ed. 1, vi, 2, p. 185.  $\boldsymbol{D}.$ 

1855. Neritina caffra Gray, Rve., Conch. Icon., pl. viii, f. 37. D.F.

1855. Neritina gagates Lam., Rve., Conch. Icon., pl. x, f. 47. D.F. 1877. ,, gagates Lam., Mts., Conch. Cab., p. 94, pl. xvi, f. 11-12. D.F.

1908. Nerita (Paranerita) gagates Lam., Bourne, P.Z.S., pp. 852, 860, 863–869, pl. liv, f. 32; pl. lv, f. 36; pl. lviii, f. 45; pl. lix, f. 48; pl. lx, f. 50; pl. lxiii, f. 60. A.

1921. Neritina (Neritina) gagates Lam., Germ., Faune Mascareignes, p. 382. N.F. Synonymy.

1922. Theodoxus gagates Lam., Cawst., S. Afr. J. Sci., xix, p. 278.  $N.\,$ 

1923. Neritina gagates Lam., Baker, Proc. Acad. Phila., lxxv, pp. 137, 144, pl. xi, f. 11. R.

1937. Neritina gagates Lam., Andrews, J. Morphol., lxi, pp. 530, 535, 539, pl. iv, f. 24; pl. v, f. 33. A.

Shell of fair size, nearly oval, rather dull, black or black-brown, normally with broad vertical brown zigzag flames which, however, are frequently obscured by the thick black periostracum; interior bluish white, with a greenish zone within the outer lip and a yellow area on the paries. Spire very short, summit hardly projecting out of the curve. Whorls little more than 2, 1st minute, sculpture consisting of strong, close, fairly regular growth lines cut by equally close, strong and regular, continuous, narrowly zigzagged spiral grooves; suture shallow but well defined. Aperture segmental, columella straight and plain for a short distance at each end, slightly incurved and denticulate in the middle. Operculum strong, concave, dark bluish slate, outer border blood red, inner surface light red. An Umgeni example measures

Alt. 18, lat. 15; apert. alt. 13.5, lat. 6.0; last whorl 17.8 mm.

Hab. NATAL. Tongaat; Umkomaas; Umgeni Lagoon (Cawston). Type ubi?.

A well-known Mascarene species, distinguishable from the following by the apertural coloration; Baker places it in his sub-genus Vittina (l.c., 1923, pp. 132, 144); I am informed, however, that the radula of a specimen from Umkomaas differs widely from Baker's figure of one from Mauritius, and the specific identity of the Natal specimens seems to require further investigation.

#### Neritina knorri Récl.

### Ref. List No. 573.

1772. Nerite á bouche jaune, Knorr, Vergnügen, part 6, p. 24, pl. xiii, f. 3. D.F.

1841. Neritina knorri Récl., Rev. Zool. Soc. Cuv., p. 274. D.

1925. Theodoxus knorri Récl., Conn., Trans. R. Soc. S. Africa, xii, p. 212. L.

1929. Neritina (Clypeolum) pulligera knorri Récl. (=stumpffi and rhysodes O. Bttg.), Haas, Zool. Jahrb. Jena, lvii, p. 428, pl. ii, f. 25–27.

Rather longer in comparison with the foregoing, uniform black or brown, sometimes with numerous small black dots or flecks, and normally distinguished by the coloration of its aperture, which is bluish white inside, with a broad band of bright orange-red round the outer lip and a black or dark violet-blue parietal area; the parietal wall, in ordinary frontal aspect, is comparatively horizontal, only sloping a little upwards from left to right, whereas in natalensis and gagates it is oblique, with a far steeper upward slope. The operculum of a Madagascar example is porcellanous, with internal peg and rib strongly developed, externally with beautiful onyx-like curved, narrow chocolate bands radiating from the nucleus on a pale ground, and a rather broad chocolate outer margin; the shell to which it belongs, brown with black dots, measures

Alt. 26, lat. 18.5; apert. alt. 23, lat. 13 mm.

Martens describes the operculum as dull flesh with a reddish black border, which is the prevailing colour, but I have seen several specimens tending towards the beautiful onyx-like ornamentation described above.

Hab. LORENZO MARQUES. Inhambane (Peters). Type ubi?.

Described from Madagascar and not uncommon in Zanzibar.

Genus Septaria Fér., 1807 (Essai Méth. Conch., pp. 36, 60). Type Patella borbonica Bory. (=Navicella Lam., 1816).

Shell nearly symmetrical, depressed, cap-shaped, with apex at hind end and usually overhanging it; the parietal region forms a partition in the hind portion of the broad aperture, and although the animal cannot close the aperture there is the remnant of an operculum in a pocket above the foot in the shape of an irregular four-sided calcareous plate, with a triangular or spiniform projection to the left front answering to the rib in *Neritina*.

Internal anatomy differing little from that of *Neritina*, the radula being of the same type, and the genus is also found in lagoons of slightly brackish water.

More than one species may occur in Natal, but I have only identified the following:—

Septaria tessellaria (Lam.). (Pl. xvii, f. 20–21.)

1816. Navicella tessellaria Lam., Enc. Méth. Vers., p. 12, pl. cccclvi, f. 3-4. F.

1822. Navicella tessellata Lam., Hist. An. s. Vert., Ed. 1, vi, 2, p. 182. D.

1838. Navicella tessellata Lam., Hist. An. s. Vert., Ed. 2, viii, p. 564. D.

1881. Navicella tessellata Lam., Mts., Conch. Cab., p. 37, pl. vii, f. 8-17; pl. viii, f. 1-9. D.F. Synonymy.

1922. Septaria sp., Cawst., S. Afr. J. Sci., xix, p. 278. N.L.

1923. ,, ,, ,, Trans. R. Soc. S. Africa, xi, pp. 120, 121. L.

1925. Septaria tesselata Lam., Cawst., J. Trop. Med. Hyg., xxviii, p. 365. F.

1925. Septaria tesselata Lam., Cawst., Ann. Trop. Med. Parasit., xix, p. 217, f. 9. F.

1927. Septaria tesselata Lam., Cawst., Observation, p. 16. R.

1937. " tessellata Lam., Andrews, J. Morphol., lxi, p. 534, pl. iv, f. 18, 19.  $\,A$ .

Shell depressed ovate or oblong, sides more or less convex, nearly equally rounded fore and aft, greatest breadth usually a little behind the middle, apex slightly turned to right, just overhanging rear margin; periostracum thin, opaque, faintly longitudinally striate, ornamentation reticulate, with pale elongate yellow spots, often with black margin in front, pale rayed or blackish; septum white and glossy, sinuate in front, sides smoothly malleate, central area bearing transverse striae of irregular strength and distance apart with curve parallel to that of its front; a strong muscular scar runs forward along each side about 3rds of the total length from within the septate cavity and widening anteriorly. Operculum of a large narrow specimen nearly rhombic, about half length of shell, with a spiny forward projection on the left; thin, glossy and almost nacreous, upper surface, of which the lower is the exact converse, divided into 3 triangular areas or sections, the front and rear sloping slightly downward to the main or centre one, of which the apex is situate about half-way up the left margin and sides extend to the opposite corners, and which bears strong, fine radial and transverse striae; the front section, with apex at right fore corner, has considerably weaker striation, while the hindermost, nascent section is almost gelatinous and nearly smooth. This degenerate operculum is contained in a deep pocket formed by the upper surface of the foot and the lower part of the body, which are united all round except for a horizontal slit in rear, through which is just visible the operculum, which rests flat attached to the upper surface of the foot, below the lower portion of the visceral mass.

Hab. NATAL. Umkomaas; Illovo; Karridene; Amanzimtoti (Cawston).

Type in coll. Lamarck.

This species has been so fully treated by Martens that I omit most other references except those recording its discovery in South Africa; Martens places in its synonymy Catillus lineatus Ads., Navicella clypeolum and ambigua Récl., récluzii, radiata, pulchella, insignis, atra and variabilis "Récl." Rve., maculifera Mouss. and picturata Garrett, none of which were described from Africa or affect the status of the Natalian form, which is in complete agreement with large series

of tessellaria from Ceylon and the Philippine Islands in the British Museum.

Lamarck first published this species under the name of tessellaria, and while citing the original reference, altered it to tessellata in his subsequent writings without assigning any reason whatever for such alteration; the name originally given should therefore hold good.

#### CLASS PELECYPODA

### (or Lamellibranchia).

Molluscs with an internal and external symmetry. The cephalic region is rudimentary, and the mantle, divided into a right and a left lobe, secretes a bivalve shell which covers and encloses the whole body. The cephalic region is only furnished with a pair of labial palps on each side; the foot is ventral, generally adapted to burrowing and without a plantar surface; the 2 pallial lobes are united by 1 or 2 transverse muscles which close the 2 valves of the shell. There are 2 lateral and symmetrical ctenidial branchiae under the mantle, their distal extremities are directed posteriorly and their filaments may exhibit an extreme degree of concrescence, either among themselves or with the mantle or with the visceral mass (Pelseneer).

#### Order Eulamellibranchia.

Mantle edges generally united by 1 or 2 sutures; 2 adductor muscles usually present; branchial filaments united at regular intervals by vascular junctions transforming the linear interfilamentar spaces into a series of fenestrae; lamellae of each gill-plate having vascular junctions and forming afferent vessels; gonads with their own external orifices (after Pelseneer).

#### SUBORDER Submytilacea.

Mantle slightly closed, generally only a single suture; siphons absent or very short; gills smooth. Nearly always dimyarian. Shell equivalve, with an external ligament (after Pelseneer).

### FAMILY UNIONIDAE Swainson (restricted).

Diaphragm complete, formed only by the gills; outer laminae of outer gills connected with mantle at its posterior end; anterior end of inner gills separated from palpi by a more or less wide gap. Margins of mantle drawn together by the gill diaphragm, but not united, thus

separating the anal from the branchial opening, and the anal generally closed above by the union of the margins of the mantle, rarely remaining open, and when closed always leaving a supra-anal opening which is very rarely obliterated. Gills always with water tubes, formed by interlamellar connections developed as continuous septa, running parallel to the gill-filaments. Marsupium formed by all 4 gills, or by outer gills alone, or by parts of outer gills. Glochidia of various shapes, suboval, subtriangular, or celt-shaped, with or without hooks on ventral margin (after Ortmann).

Genus *Unio* Retzius, 1788 (Nov. Test. Genera, p. 16).

Type, selected by Gray in 1847, Mya pictorum Lin.

Freshwater bivalves covered with a strong epidermis, having an external ligament; hinge provided in species here treated with strong teeth and prominent muscle scars.

Mantle connection between anal and supra-anal moderately long, generally almost as long as anal. Inner lamina of inner gills free, except at anterior end. Marsupium formed by outer gills. Glochidia moderately large, subtriangular, with a hook on ventral point of each valve (after Ortmann).

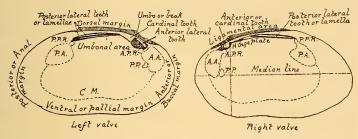
The diagram on p. 605 illustrates the technical terms most usually employed in the description of a Unio, many of which are applicable in the case of other genera.

Section Cafferia Simpson, 1900 (Proc. U.S. Nat. Mus., xxii, p. 824). Type Unio caffer Krs.

Shell elongate or elliptical, rhomboid and solid when old; beaks full, sculpture corrugated zigzag, the ridges often extending over the disc; epidermis dull, yellowish brown to nearly black, somewhat sulcate, teeth rather strong, muscle scars deep, well defined (Simpson, 1900).

Animal: anal opening separated from supra-anal by a moderate mantle connection, slightly shorter than the anal; supra-anal about as long or slightly longer than anal, latter with inner edge almost smooth. Branchial opening with distinct papillae; no differentiating structures on mantle edges in front of branchial. Palpi subfalciform, of moderate size, their posterior margins united for nearly half their length. Gills of Unionid type; gill diaphragm complete, separating

anal and branchial openings; anterior end of inner gills widely remote from palpi; inner lamina of inner gill free from abdominal sac, except at anterior end. Septa and water tubes present, the former continuous and not interrupted, parallel to the gill-filaments; in the male, and in the inner gill of the female, they are weak and distant from each other. Outer gill of female marsupial practically in its



Text-fig. 56.—Unio caffer verreauxi Krs., showing interior of valves (about  $\frac{1}{3}$  natural size).

P.A. = Scar of posterior adductor muscle.

P.P.R. = Scar of posterior pedal retractor muscle (sometimes lettered R.P.P.).

A.A. = Scar of anterior adductor muscle.

A.P.R. = Scar of anterior pedal retractor muscle (sometimes lettered R.P.A.).

P.P. = Scar of pedal protractor muscle (sometimes lettered P.P.A.).

C.M. = Scar of circumpallial muscle, or pallial line.

entire length, with heavy and crowded septa. When charged, the marsupium is moderately swollen, the edge remaining sharp. Placentae lanceolate and compressed, moderately developed when eggs are present, less so when glochidia are present; glochidia subtriangular, longer than high, lower margin bluntly pointed in the middle, hooks doubtful (after Ortmann).

# Unio caffer Krs.

Ref. List Nos. 576, 577, 579 and 580.

1848. *Unio caffer* Krs., Südafr. Moll., p. 18, pl. i, f. 14. D.F.

zeyheri Mke., Zeitschr. f. Malak., v, p. 28. D. 1848.

1851. cyamus Phil., ibid., p. 125. D.

verreauxianus Lea, Proc. Acad. Nat. Sci. Phila., viii, 1856. p. 94. D.

1856. Unio africanus Lea, ibid., p. 94. D.

rectilinearis Sow., Conch. Icon., pl. lxv, f. 332. D.F. 1868.

vaalensis Chaper, Bull. Soc. Zool. Fr., x, p. 480, pl. xi, f. 1-3. D.F.

1886. Unio fissidens Bttg., Ber. Senckenb. Ges., p. 27, pl. ii, f. 6-7. D.F.

1886. Unio hygapanus Bttg., ibid., p. 26, pl. ii, f. 5. D.F.

1898. *Unio caffer* Krs., var. *pentheri* Stur., S.A. Moll., p. 91, pl. iii, f. 64-65. *D.F.* 

1910. Unio mashonae Prest., A.M.N.H., vi, p. 61, pl. iv, f. 10. D.F.

1910. ,, charon, Prest., ibid., p. 60, pl. iv, f. 6. D.F.

1910. , vicinus Prest., ibid., p. 60, pl. iv, f. 7. D.F.

1912. ,, silongweensis (=vicinus Prest., 1910, non Lea, 1856) Prest., Nautilus, xxvi, p. 35. Nom. emend.

1914. Unio (Cafferia) caffer Krs. (=zeyheri, cyamus, verreauianus, verreauxi, navigoliformis, natalensis, and rectilinearis) cum var. africanus Lea (=caffer Krs., Küst., pars, and niloticus Küst.), var. vaalensis Chaper and var. pentheri Stur., Simpson, Cat. Naiades, p. 574. D.

1918. Unio caffer Krs., Ortmann, Nautilus, xxxi, p. 75. A.

1925. ,, ,, ,, Cawst., Parasitology, xi, p. 94. N.

1925. Cafferia caffra Krs., Conn., Rec. Albany Mus., iii, p. 262, pl. xii (lettered xi in text), f. 2. N.F.

1930. Cafferia caffra Krs., Conn., Ann. S.A. Mus., xxix, p. 322. N. 1931. ,, ,, (= mashonae Prest.), Conn., A.M.N.H., viii, p. 309. N.

1936. Cafferia caffra Krs. (=fissidens and hygapanus Bttg., connollyi Pilsb., verreauxi Charp., caffra obesa Conn., charon and silongweensis (=vicinus Prest.), Haas, Abh. Senckenb. Ges., No. 431, p. 49, pl. iii, f. 4, pl. iv, f. 1. D.F. Synonymy.

Shell oblong oval, solid, more or less inflated, olive-yellow or brown with darker zones, nacre smooth, whitish, pale yellow or rarely roseate; beaks only moderately full, ventral margin straight or incurved, dorsal curved, posterior end rounded, sometimes rather narrowly, anterior broader, sometimes shouldered above; beak sculpture zigzag, generally over a wide or very wide area, but occasionally almost absent, remainder of shell bearing concentric costulae or striae, usually strong but in some races nearly smooth; hinge moderately solid.

Right valve: anterior tooth triangular, 11 mm. at base, moderately projecting, posterior lateral straight, narrow, 28 mm.; left valve: anterior lamella 7·2, posterior laterals 29 mm., not greatly divergent. The shell described, from Rietfontein, measures

Long. 78, alt. 42.5, crass. 26 mm., beaks in  $\frac{1}{3}$ rd length.

Simpson separates africanus Lea as a variety as being thinner, less inflated and smoother than type, but in a species so variable that it would be possible to allot a varietal name to almost every individual race it appears useless to perpetuate such names, some of which are simply based on immature specimens. *U. vaalensis* is merely

immature, and I have previously shown that mashonae is identical with caffer, but of the other synonyms cited by Simpson it has been pointed out recently that navigioliformis Lea is a South American Diplodon, while verreauxi is worthy of at least subspecific rank.

Hab. SOUTH AFRICA (cyamus in coll. Largilliert).

NATAL (caffer, Wahlberg); Umpingave R. (natalensis, McKen); Umsinduzi R., Pietermaritzburg (Burnup).

ZULULAND. Mazimba Hill, Black Umfolozi R. (Haas).

TRANSVAAL. Crocodile R. and Pretoria District; Vaal R., Standerton and Christiania, etc.; Mooi R., Potchefstroom; Hex R., Rustenburg; fairly frequent in smaller streams in the Transvaal as far north as Pietersburg.

ORANGE FREE STATE. Riet R., Winburg (fide Sturany); Rhenoster R., south of Heilbronn (Connolly).

CAPE PROVINCE (africanus and verreauxianus, Verreaux; zeyheri, Zeyher); Izeli R., near King Williamstown (Godfrey); Port Elizabeth Dist. (Crawford); Vaal R., Barclay (vaalensis, Chaper); Great Fish R., west of Cradock (Johnson); Bloemfontein R., Fraserburg (Rogers).

CAPE PENINSULA. Retreat Vlei (Lightfoot).

LITTLE NAMAQUALAND. Orange R., Henkries (Lightfoot).

GREAT NAMAQUALAND. Stolzenfels, Orange R. (Thomsen); Klein Karas (Miss Hill).

GRIQUALAND WEST. Invani and Riverton, Vaal R. (Miss Wilman); Witkop, Gordonia; Inkbosch Pass, Molopo (subfossil, Rogers).

BECHUANALAND. Hartz R., Taungs (Miss Wilman).

BRITISH BECHUANALAND. Nosob-Hygap watercourse, east of Kebeum (fissidens and hygapanus, subfossil, Nolte).

S. RHODESIA. 16 miles from Enkeldoorn (mashonae, Miss Sharpe-Young); Ngamandhlovu (Stevenson); Victoria Falls (Miss Leppan); Umgusa R., Sawmills; Malemi R., Matopos (Arnold); Shangani, Ingezi R. (Miss Mackie).

U. charon and silongweensis were described from Nyasaland.

Type of caffer in Stuttgart, africanus, natalensis, and verreauxianus in Washington, rectilinearis and mashonae in British, fissidens and hygapanus in Senckenberg, pentheri in Vienna Museums; zeyheri lost; vaalensis in École des Mines, Paris, charon and silongweensis in Tervueren Museum.

Cawston collected at Potchefstroom a number of specimens with small pearls attached to the shell.

The above are only a few of the localities reported for this widespread South African species, but serve to show some extent of its distribution; notwithstanding, however, its great variation and diffusion, the two forms which follow appear to be worthy of subspecific rank.

Sub-species verreauxi Küst.

(Pl. xviii, f. 15-22.)

Ref. List No. 576 (pars).

1856. *Unio verrauxi* Charp., Küst., Conch. Cab., p. 150, pl. xliii (1855), f. 6. D.F.

1859. Unio diminutis Lea, Proc. Acad. Nat. Sci. Phila., iii, p. 151. D.

1860. *Unio diminutus* Lea, Journ. Acad. Nat. Sci. Phila., iv, p. 254, pl. xxxix, f. 134. *D.F.* 

1865. Unio diminutus Lea, Rve., Conch. Icon., xvi, pl. xxviii, f. 141. D.F.

1874. Unio diminutus Lea (=gracilis Parr. in MS.), Jick., Fauna N.-O.-Afr., p. 280. D.

1891. Unio verreauxi Charp., Smith, A.M.N.H., viii, p. 319. N. 1900. Nodularia diminuta Lea, Simpson, Proc. U.S. Nat. Mus.,

xxii, p. 826. N.

1914. Unio diminutus Lea, Simpson, Cat. Naiades, p. 583. D.

1923. ,<br/>, verrauxi Küst., Pilsb., Proc. Acad. Nat. Sci. Phila., lxxv, p. 277. <br/> N.

1925. Cafferia caffra verreauxi Charp., Conn., Rec. Albany Mus., iii, p. 261, pl. xii (lettered xi in text), f. 3 and 5. D.F.

Differs from caffer by comparatively greater altitude in proportion to length, as will be seen from the undermentioned tables:

U. verreauxi :	Long.	mm. 92‡	mm. $84\frac{1}{2}$	mm. 79	mm. 76	$\frac{\text{mm.}}{73\frac{1}{2}}$
	Alt.	56	46	43	44	43
	Crass.	33	28	25	$25\frac{1}{2}$	27
$U.\ caffer:$	Long.		83		74	$73\frac{1}{2}$
	Alt.		40		36	38
	Crass.		27		$23\frac{1}{2}$	$24\frac{1}{2}$

In the  $84\frac{1}{2}$  mm. specimen mentioned above the nacre is dull flesh; in the right valve the anterior tooth bulbous, thick, projecting,  $8\frac{1}{2}$  mm. at base; posterior not very thick, slightly curved, 30 mm.; left valve, anterior lateral 7·3 mm., cardinal small but thick and bulbous, posterior laterals 25 mm., moderately divergent; P.A., A.A., and P.P. scars very strong, P.P.R. weak.

Hab. CAPE PROVINCE. Zouthenthal Vlei, Bredasdorp Dist. (type, Verreaux); Kowie R., Blaauwkrantz, near Grahamstown (Ortlepp).

U. diminutis (figs. 15-18) was described as from East Africa from a shell in the Cuming collection; it is simply the half-grown stage of verreauxi, practically coinciding with examples from Blaauwkrantz at the same stage of growth,\* and the Cumingian locality is probably incorrect, though Jickeli records the species somewhat doubtfully from Sennaar.

Type of verreauxi ubi?, diminutis in British Museum.

## Subspecies connollyi Pilsb.

1923. *Unio (Cafferia) connollyi* Pilsb., Proc. Acad. Nat. Sci. Phila., lxxv, p. 276, pl. xix, f. 3–4. *D.F.* 

1925. Cafferia caffra obesa Conn., Rec. Albany Mus., iii, p. 263, pl. xi (numbered xii in text), f. 1-4. D.F.

Shell subovate, solid, inflated, slightly gaping in front, longitudinally compressed, yellow brown; ligament normal; dorsal margin convex, beaks very prominent, situate in about \(\frac{1}{4}\) the length, anterior border irregularly curved and steeply descending above, evenly curved at its extremity, below the median line; pallial border slightly curved, usually slightly incurved beyond half-way, posterior comparatively short, little curved above, evenly so at end, with hardly any trace of ridge. Early sculpture when first visible of close, even, concentric striation on fore part, becoming somewhat rugose on hinder part of shell, changing after a length of about 34 mm. to coarse concentric costulae of irregular prominence.

Interior: nacre smooth. Right valve: anterior tooth triangular,  $11\frac{1}{2}$  mm. at base, very strongly projecting, posterior lateral lamella comparatively short,  $22\frac{1}{2}$  mm., but very prominent, strongly thickened in rear; A.A. roughly oblong, deeply impressed, with the minute, bluntly pointed A.P.R., of equal depth, projecting from its right upper corner into base of anterior lamella; P.P. small, nearly square, almost superficial, P.A. fairly deep, oblong, rounded in rear; P.P.R. ovate, very small; circumpallial scar rather strongly grooved, sometimes with 2 or 3 shallower parallel grooves above it; left valve: anterior lamella prominent and comparatively long,  $10\frac{1}{2}$  mm., posterior laterals short, 19 mm., diverging considerably to the rear.

Two large Alicedale examples measure

Long. 87.5, alt. max. 47.5, crass. 33.8 mm. ,, 82.0, ,, 48.5, ,, 31.0 ,,

Hab. PORT NATAL (connollyi, collector unknown).

CAPE PROVINCE. Bushman's R., Alicedale (obesa, Hewitt); Begha R., Peddie (fide Burnup).

Type of connollyi in Academy of Natural Sciences, Philadelphia, obesa in Albany Museum.

Comparison of the three foregoing forms yields the following results: in caffer and verreauxi there is a distinct point at extremity

\* See figs. 19-22.

of posterior margin, well below median line, and a well-marked ridge running from that point toward the umbones; in connollyi there is hardly a trace of either and the sculpture is coarser and far less even. The right cardinal tooth is weak in caffer, stronger in verreauxi, and larger and still stronger in connollyi, while in the last the right posterior lamella is much shorter, but thicker and more prominent. In verreauxi the left posterior laterals are long, even and nearly parallel; in caffer they thicken and gape slightly to the rear, while in connollyi they are much shorter and gape more widely. In caffer the A.P.R. is slightly more distinctly separated from the A.A. than in the others and the A.A. is usually nearly square instead of oblong; in caffer and connollyi the valves gape in front, in verreauxi they are nearly close all round.

Taking into consideration the great variability of *caffer* throughout the subcontinent, it may be more discreet to subordinate the other two forms to it as sub-species, at least until the anatomy is known, though there is much to be urged in favour of Pilsbry's determination of *connollyi*, at least, as a distinct species.

The four species which follow have been variously attributed to *Nodularia* Conrad and *Indonaia* Prashad (a synonym of *Radiatula* Simpson), both Asiatic genera which it may be inadvisable to perpetuate in the South African list without much further anatomical knowledge; for the present, therefore, it appears preferable to leave them in *Unio* sensu lato.

Unio mossambicensis Mts.

(Pl. xix, f. 3-6.)

Ref. List No. 578.

1859. Unio mossambicensis Ptrs., Mts., Mal. Blätt., vi, p. 218, pl. iii, f. 3–5. D.F.

1914. Nodularia mossambicensis Mts., Simpson, Cat. Naiades, p. 986. D.

1925. Indonaia mossambicensis Ptrs., Conn., Trans. R. Soc. S. Africa, xii, p. 213. L.

1925. Nodularia mossambicensis Ptrs., Germ., Miss. Rohan-Chabot, iv, p. 225. N.F.

1936. Indonaia mossambicensis Mts., Haas, Abh. Senckenb. Ges., No. 431, p. 51, pl. iv, f. 3. F.N.L. Synonymy.

Shell subrhomboid, much higher to the rear, dull brown, beaks moderately full, situate in  $\frac{2}{3}$ ths of length, anterior end rounded, dorsal and ventral margins lightly

curved, posterior nearly straight, joining ventral at a blunt angle, posterior ridge low. Beak sculpture where discernible said to show 2 short lines of isolated pimples and several fine radial lines, only extending a short distance over the remaining surface, which bears close concentric striae and wrinkles, coarser and less regular near margins. Nacre usually tinged with orange; anterior teeth short triangular, rather weak but projecting; posterior, right valve 16 mm., left valve, little divergent, about 15 mm. in length.

Long. 42, alt. max. 27, ad umbones 23.5; crass. 18 mm.

Hab. LORENZO MARQUES. Tette (type, Peters); near Mazzara, R. Zambesi (Kirk).

Type in Berlin Museum.

# Unio framesi (Conn.).

1925. Indonaia framesi Conn., Rec. Albany Mus., iii, p. 265, pl. xii (numbered in text xi), f. 1, 4. D.F.

1936. Indonaia framesi Conn., Haas, Abh. Senckenb. Ges., No. 431, p. 53, pl. iv, f. 4. N.F.

Shell rather thin, irregular trigonal, valves gaping very slightly in front, broad and inflated in comparison to its length, blackish brown. Ligament strong, bright brown, 16 mm. long, dorsal margin nearly straight, beaks not prominent, situate in 2ths of length; anterior margin evenly curved, maximum point just below median, pallial border usually nearly straight, posterior evenly curved, with no posterior ridge. Beak sculpture, when not too worn, after the shell has attained a length of 14 mm., consisting of very close, fine concentric striae, with 4 or 5 prominent growth lines at irregular intervals, on all of which are superimposed coarse transverse costae, which make a zigzag pattern towards the rear; after the shell is about 32 mm. long the sculpture changes abruptly to coarse, fairly regular, concentric costae, closer in front than behind, with traces of finer concentric striae in the intervals between them. Nacre smooth and pearly, sometimes roseate. Right valve: cardinal tooth rather long, 8.25 mm., jagged, moderately strong; posterior lateral lamella slightly curved, narrow and not prominent, 21.75 mm. in total length. A.A. deep, nearly square; A.P.R. a mere point sloping upward from its right upper corner on the surface of the anterior lamella; P.P. extremely small and shallow; P.A. suboval, of moderate depth; P.P.R. a minute, almost superficial triangle; pallial scar very weak. In the left valve the anterior lamellae are weak and the posterior laterals almost parallel, diverging but slightly to the rear. The type and two paratypes measure

> Long. 53.0, alt. max. 31.2; crass. 22.5 mm. 52.5,,, 32.0; 22.821.0 ,, ,, 28.5;

Hab. TRANSVAAL. Near Premier Mine, Pretoria (Frames); Krüger Park (Haas).

LORENZO MARQUES. Gorongoso Dist. (Wells Cole); Inhaminga (Hofmann).

Type in Senckenberg Museum.

50.25,

#### Unio kunenensis Mouss.

#### Ref. List No. 274.

1887. Unio kunenensis Mouss., J. de C., xxxv, p. 300, pl. xii, f. 10. D.F.

1914. Unio kunenensis Mouss., Simpson, Cat. Naiades, p. 586. D. 1930. Indonaia kunenensis Mouss., Conn., Ann. S.A. Mus., xxix, p. 322. N.

1936. Indonaia kunenensis Mouss. (=croninae Walker, rohani and ellenbergeri Germ. & zambesiensis Prest.), Haas, Abh. Senckenb. Ges., No. 431, p. 50, pl. iv, f. 2. F. Synonymy.

Shell subrhomboid, subinflated, solid, pale green when young, brown to blackish brown when mature; beaks moderately full, in  $\frac{2}{7}$ ths of length; anterior margin evenly rounded, basal and dorsal well curved, posterior sloping outwards in a nearly straight line to meet the basal in a narrow curve, posterior ridge not greatly pronounced. Nacre varicoloured, usually with an orange tinge; ligament short but strong; anterior teeth very short but strong and projecting, posterior strong, nearly straight, single and longer in right valve, double, little divergent, upper 15 and lower 19 mm. in left; scar of A.A. muscle very strongly impressed in both valves, others very weak, P.P. oblique, rather long and narrow. Beak sculpture consisting of strong, somewhat granulose zigzag lines, usually covering a wide area; rest of shell with irregular, granulose concentric striae.

Long. 51.5, alt. max. 35.0, ad umbones 32.0; crass. 21.0 mm.

Hab. OVAMBOLAND. Kunene R. (type, Schinz) and near Great Falls (Barnard); Okovango R., near Kuringkuru (Dickman); between Dirico and Andara (Staunton); near its junction with Omuramba-Omataka R. (Shortridge).

BRITISH BECHUANALAND. Okovango and Botletle District, and in the salt pans of the Makarrikari brook (fossil, Passarge).

Haas cites several localities in S. Angola and N. Rhodesia; I give his proposed synonymy without comment.

Type in Zurich Museum.

#### Unio zambesiensis Prest.

#### Ref. List No. 582.

1905. *Unio zambesiensis* Prest., Proc. Mal. Soc., vi, p. 300, f. 1; p. 301. *F.D.* 

1914. Unio zambesiensis Prest., Simpson, Cat. Naiades, p. 724. D.

Extremely near the preceding, from which it possibly differs in comparatively shorter, more compact form, due to the greater declivity of the posterior slope, which therefore meets the basal in a more gentle curve than in kunenensis. The beaks, perhaps through erosion, are little pronounced, situate in about  $\frac{2}{3}$ ths of length; posterior teeth about 14.5 mm. in length. A paratype measures

Long. 35·0, alt. max. 25·0, ad umbones 22·5, crass. 14·2 mm.

Hab. S. RHODESIA. Victoria Falls (type, Morrell). Also known from Northern Rhodesia. Type in British Museum.

## FAMILY MUTELIDAE Gray (emended).

Diaphragm complete, formed anteriorly by gills, posteriorly by firm union of mantle margins. Anterior end of inner gills in contact with palpi; branchial and anal siphon sharply separated by union of mantle margins; anal opening open, or closed above, in latter case without forming a supra-anal opening. In some genera the mantle margins unite also in front of the branchial opening. Gills with very indistinct intercommunicating water tubes, and interrupted interlamellar connections, or with well-developed water tubes and septa, parallel to filaments. Marsupium formed only by inner gills; larvae are glochidia or lasidia (after Ortmann).

Elongate shells somewhat resembling those of the Unionidae, but teeth either very weak or more usually absent.

# Genus Mutela Scopoli, 1777 (Intr. Nat. Hist., p. 397).

Type Mytilus dubius Gmel. (Le Mutel of Adanson).

Shell elongate, slightly inflated, with low smooth beaks and rounded posterior ridge; surface faintly concentrically grooved; epidermis rayless; hinge straight, having generally vestiges of taxodont teeth; dorsal scars an irregular row, extending downward and forward; muscle scars irregular. Mantle concrescent below branchial orifice for one-fourth to about half of basal length.

# Mutela mabilli (Rchbr.).

# (Pl. xix, f. 1-2.)

1886. Mutelina mabilli Rchbr., Bull. Soc. Mal. Fr., iii, p. 7. D., paludicola Rchbr., ibid., p. 8. D.

1908. ,, mabillei (=paludicola) Rchbr., Germ., L'Afr. Centr. Fr., p. 569. D.

1909. Mutelina mabillei Rchbr., Germ., Bull. Mus. Paris, xv, p. 476. D.

1914. Mutela mabilli Rchbr., Simpson, Cat. Naiades, p. 1360. D.

1927. Mutela mabilli Rchbr., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, p. 433, pl. xli, f. 1. D.F.

1929. Mutelina mabilli Rchbr., Haas, Senckenbergiana, xi, p. 115 (in synonymy).

1930.  $Mutela\ mabilli\ Rehbr.,\ Conn.,\ Ann.\ S.A.\ Mus.,\ xxix,\ p.\ 324.$  N.

1936. Mutela nilotica mabilli Rchbr., Haas, Abh. Senckenb. Ges., No. 431, p. 100, pl. viii, f. 4. N.F.

Shell somewhat cuneiform, shortly rounded and gaping in front, elliptically subrostrate behind, thin, translucent, dark to blackish brown, concentrically striate, radiate in front, dorsal margin ascending in a straight slope to the point of greatest altitude in rear, ventral nearly straight, hinge simple, nearly straight, 50 mm. long, dorsal scars as in genus, muscle scars strongly pronounced.

Long. 93, alt. max. 42.5, ad umbones 32.5; crass. 19.5 mm.; beaks in about

one-fourth length.

Hab. OVAMBOLAND. Okovango R. (Shortridge; Staunton).

Described from Gancini, Congo, just within French territory and recorded from L. Chad and the Belgian Congo.

Type ubi?.

Haas relegates this species, in company with angustata Sow., rostrata Rang, and iris, langi, and garambae P. & B., to the synonymy of M. nilotica Caill. He may well be correct, but the Okovango specimens agree better with P. & B.'s figure of mabilli than with those of the other species cited, so it may be advisable to retain that name for them for the present without prejudice to possible synonymy.

## Mutela rostrata (Rang).

1835. Iridina rostrata Rang, Nouv. Ann. Mus. Paris, p. 316. D.

1836. ,, coelestis Lea, Syn. Naiades, p. 57. D.

1879. Mutela coelestis Rang, sp., Mts., Monatsb. Akad. Wiss. Berlin, p. 742. L.

1925. Mutelina rostrata Rang., Conn., Trans. R. Soc. S. Africa, xii, p. 213. L.

Hab. LORENZO MARQUES. Tette (Peters).

It will be seen from the preceding note that Haas considers both this species and *mabilli* to be identical with *M. nilotica* Caill., and as the only record of *rostrata* from South Africa is contained in Martens' dubious citation of 1879, it appears scarcely necessary to include further particulars of Rang's species in the present work.

Genus Aspatharia Bgt., 1885 (Esp. Nouv. Tanganika, p. 14).

Type Margaritana vignouana Bernardi

(=Spatha auctt., non Lea).

Pilsbry and Bequaert have shown that Spatha Lea was originally a monotypic genus including only M. nilotica Sow.; it accordingly becomes a synonym of Mutela s.s. and yields place to Aspatharia for the well-known species formerly attributed to it.

Shell oblong or oval, hinge plate toothless, more or less abruptly terminated in rear by the deep triangular sinulus and often with a blunt toothless prominence under the beak of the left valve; scar of foot protractor muscle lengthened in direction of shell axis. Mantle very shortly concrescent below branchial orifice or entirely open between branchial and pedal orifices.

## Subgenus Aspatharia s.s.

Beaks corrugated, corrugation diverging in a very broad inverted V shape, rest of shell smooth or corrugate tuberculate; mantle margins wholly open between branchial and pedal orifice.

# Aspatharia pfeifferiana (Bernardi). (Pl. xix, f. 7-8.)

1860. Margaritana pfeifferiana Bernardi, J. de C., viii, p. 331, pl. xii, f. 1-2. D.F.

1883. Spatha sinuata Mts., Sitz.-Ber. Ges. Nat. Fr. Berlin, p. 73. D. 1885. ,, ,, ,, Conch. Mitth., ii, p. 190, pl. xxxiv, f. 5-7. D.F.

1886. Spathella protchei Rchbr., Bull. Soc. Mal. Fr., iii, p. 8. D.

1897. Spatha stuhlmanni Mts., D.O.A., iv, p. 250. D.F.

1898. Spatha cryptoradiata Putz., Bull. Soc. Mal. Belg., xxxiii, p. xxiv, f. 8-9. D.F.

1907. Spatha (Leptospatha) sinuata Mts., Germ., L'Afr. Centr. Fr., p. 557. N.

1913. Mutela lukuluensis Prest., Rev. Zool. Afr., iii, p. 61, pl. vi, f. 4. D.F.

1913. Mutela mathildae Prest., ibid., p. 61, pl. vi, f. 7. D.F.

1914. Spatha sinuata Mts., Simpson, Cat. Naiades, p. 1333. D.

1927. Aspatharia sinuata Mts. (=lukuluensis and mathildae Prest.),

P. & B., Bull. Amer. Mus. N.H., liii, p. 417, pl. xxxv, f. 1-4; pl. xxxvi, f. 1-3a. D.F.

1928. Aspatharia sinuata Mts., Spence, J. of C., xviii, p. 216. L. 1929. ,, (Aspatharia) pfeifferiana Bernardi (=protchei Rchbr., cryptoradiata Putz., sinuata and stuhlmanni Mts., and lukuluensis Prest.), Haas, Senckenbergiana, xi, p. 112. N. Synonymy.

1930. Aspatharia sinuata Mts., Conn., Ann. S.A. Mus., xxix, p. 323. N.

1936. Aspatharia (Aspatharia) pfeifferiana Bernardi, Haas, Abh. Senckenb. Ges., No. 431, p. 90. N.

Shell subelliptical, a little broader behind, beaks moderately full, both ends well rounded, posterior somewhat produced a little below the median line, dorsal margin lightly curved, ventral strongly incurved medially; epidermis dark to blackish brown, nacre varicoloured, not very iridescent; umbonal area eroded in all the many examples examined, later sculpture consisting of fine, close, regular, concentric striae, coarser near margin of well-grown shells, crossed by fine, close axial rays. Ligament strong, hinge simple, 36 mm. from beak to rear, muscle scars large, impressed.

Long. 82.5; alt. max. 40.0, ad umbones 36.0; crass. 23 mm.

Hab. OVAMBOLAND. Okovango R. (Shortridge).

S. RHODESIA. Hunyani Drift, 20 km. south of Salisbury (Haas).

A. pfeifferiana was described from West Africa, protchei from French Congo, mathildae from Nyasaland, stuhlmanni, sinuata, lukuluensis and cryptoradiata from the Belgian Congo. Notwithstanding the synonymy proposed by Haas in 1929, I thought it preferable in 1930 to retain for the Ovambo race the name of sinuata Mts.; in his latest paper, however, Haas produces so much further evidence in support of his former proposal that there appears to be no option but to adopt it, and apply the earlier name of pfeifferiana to the entire group of nearly allied West African forms which Haas unites under it.

Shortridge collected his bivalves in sand-banks in the bed of the Okovango close to its junction with the Omuramba-Omataka River, where, he writes, he "had to practically dive for them in the sandbanks, keeping a native to look out for crocodiles all the time."

Type ubi?.

Subgenus Spathopsis Simpson, 1900 (Proc. U.S. Nat. Mus., xxii, p. 857).

Type Anodonta guillaini Récl.

Beaks with short concentric waves, rest of shell smooth or rarely with some corrugations on posterior slope or border. Lunule very narrow, its border slightly higher in right valve; mantle margins shortly concrescent below branchial orifice.

# Aspatharia wahlbergi (Krs.).

Ref. List Nos. 583, 585.

1848. Iridina wahlbergi Krs., Südafr. Moll., p. 19, pl. ii, f. 1. D.F.

1864. Spatha natalensis Lea, Proc. Acad. Nat. Sci. Phila., p. 113. D.

1898. maitenguensis Stur., S.A. Moll., p. 92, pl. iii, f. 66. D.F.

1914. Spatha wahlbergi Krs. (= natalensis Lea), cum var. hartmanni Mts. (=tabula Sow.), var. bourguignati Bgt. (=spathuliformis and bloyeti Bgt.), and var. dorsalis Mts., Simpson, Cat. Naiades, p. 1326. D.

1918. Spatha wahlbergi Krs., Ortm., Nautilus, xxxi, p. 77. A.

,, Conn., Trans. R. Soc. S. Africa, xii, 1925. p. 213. N.

1925. Spatha wahlbergi Krs., Marshall, Proc. U.S. Nat. Mus., lxvii, 4, p. 5, pl. iv, f. 3. Sculpture.

1927. Spatha wahlbergi Krs., Schlesch, Arch. f. Moll.-K., p. 200, pl. x, f. 1. N.F.

1930. Spatha wahlbergi Krs., Conn., Ann. S.A. Mus., xxix, p. 322. N.

1936. Aspatharia (Spathopsis) wahlbergi wahlbergi Krs., Haas, Abh. Senckenb. Ges., No. 431, p. 94, pl. vii, f. 5. F.N.L.

Shell very large, elongate elliptical, brown or yellow-brown, beaks slightly prominent, situate in rather less than 1rd length, sculptured on the extremities with concentric rugae, which soon develop into close, regular, concentric striae of somewhat varying strength and normally without corrugation. Anterior margin evenly rounded, basal and dorsal gently curved and parallel, posterior produced, rather narrowly rounded below median line as it merges into basal; ligament strong but not very long, nacre varicoloured, hinge plate sharply truncate in rear by the strong deep sinulus, A.A., P.P., and P.A. scars deeply impressed, pallial line deep at ends, well defined. A large Transvaal example measures

Long. 127, alt. max. 59, ad umbones 56; crass. 32 mm.

Hab. TRANSVAAL. Aapies R. (type, Wahlberg); Crocodile R. (Day); Middelburg (Crawford); Dwars R., 40 miles north of Pietersburg (Braine).

NATAL. Umpingave R. (natalensis, McKen).

ZULULAND. Enselini R. (Anderson).

BRITISH BECHUANALAND. Lotsani R., Palapye (Vissel).

OVAMBOLAND. Junction of Okovango and Omuramba-Omataka Rivers (Shortridge).

LORENZO MARQUES. Tette (Peters); L. Pavi, Inhambane (Junod).

S. RHODESIA. Maitengue R. (maitenguensis, Penther); Bula-

wayo (coll. Crawford); Sawmills, Umgusa R. (Arnold); Battlefields (Parkinson); Gazaland (Swinnerton).

Type of wahlbergi in Stockholm, maitenguensis in Vienna Museum. Widely distributed northward as far as Abyssinia, where A. hartmanni Mts. is at most but a trivial variety of Krauss' species; the unique type of maitenguensis Stur. agrees perfectly with wahlbergi at the same stage of growth.

#### var. dorsalis Mts.

#### Ref. List No. 585.

1897. Spatha wahlbergi Krs., var. dorsalis Mts., D.O.A., p. 247. D. 1925. ,, ,, ,, ,, ,, Conn., Trans. R. Soc. S. Africa, xii, p. 213. L.

"Beaks further forward, in  $\frac{3}{4}$ ths to  $\frac{1}{4}$ th length, hence the hinder margin longer; pallial line only a little lengthened."

Long. 136, alt. 67, crass. 41 mm., beaks in  $\frac{2}{1}$ ths length, 127, ,,  $63\frac{1}{2}$ , ,, 33, ,, ,,  $\frac{1}{4}$ th, ,,

Hab. LORENZO MARQUES. Tette; Sena (Peters).

Type in Berlin Museum.

Haas (1936) unites this with the typical form.

## Aspatharia petersi (Mts.).

## Ref. List No. 584.

1859.  $Spatha\ petersi\ \mathrm{Mts.},\ \mathrm{Mal.}\ \mathrm{Bl\ddot{a}tt.},\ \mathrm{vi},\ \mathrm{p.}\ 218,\ \mathrm{pl.}\ \mathrm{iii},\ \mathrm{f.}\ 1-2.$  D.F.

1864. Spatha modesta Lea, Proc. Acad. Nat. Sci. Phila., p. 109. D.

1914. , petersi Mts. (=modesta Lea), Simpson, Cat. Naiades, p. 1335. D.

1925. Spatha petersi Mts., Conn., Trans. R. Soc. S. Africa, xii, p. 213. L.

1936. Aspatharia (Spathopsis) petersi Mts., Haas, Abh. Senckenb. Ges., No. 431, p. 97, pl. vii, f. 6. D.F.

Differs from the foregoing in far lower altitude and in its dorsal and basal margins being nearly straight instead of curved, and not parallel, owing to the former sloping gradually upwards to the rear. In other externals, strong muscular sears and very strong simulus it is similar to wahlbergi. The largest shell measured by Martens was

Long. 79, alt. 35; crass. 19 mm., beaks in  $\frac{1}{3}$ rd length, and 2 single valves from near Mombasa are  $94\times43$  and  $84\times37$  mm. in length and height.

Hab. LORENZO MARQUES. Tette (type, Peters); Itschongove (Schenck); Nkomati R., Rikatla (Junod).

TRANSVAAL. Komati-Poort (Lang); Kruger Park (several localities, Haas).

S. RHODESIA. Lundi Hotel, between Beit Bridge and Fort Victoria; Hunyani Drift, 20 km. S. of Salisbury (Haas).

Also known from East Africa.

Type of petersi in Berlin, modesta in Washington Museum.

#### FAMILY CYRENIDAE.

Shell trigonal to oval, solid, porcellanous; hinge plate bearing 2 or 3 cardinal teeth diverging from the beaks in each valve, and anterior and posterior lateral teeth. Ligament external, pallial line in African genera entire. Mantle free except posteriorly, where a partition divides off a siphonal cavity; siphons short and separate or mere orifices; gills concrescent posteriorly, labial palpi triangular (Pilsbry and Bequaert).

Genus Corbicula Meg., 1811 (Mag. Ges. Naturf. Fr. Berlin, p. 56). Type Tellina fluminalis Müll.

Lateral teeth long, usually closely crenulate; pallial sinus entire. Exterior usually bearing strong concentric sculpture.

# Corbicula africana (Krs.). (Pl. xviii, f. 10–14.)

Ref. List Nos. 586, 589, 590, 592.

1846. Cyrena radiata Parr., Phil., Abb. u. Beschr., ii, p. 78, pl. xi, 4, f. 8. D.F.

1848. Cyrena africana var. olivacea (= gauritziana Krs. in litt. and radiata Parr.), Krs., Südafr. Moll., p. 8, pl. i, f. 8. D.F.

1877. Corbicula natalensis Krs., Cless., Conch. Cab., p. 155, pl. xxvii, f. 19–21. D.F.

1899. Corbicula fluminalis Müll., Pons., Proc. Mal. Soc., iii, p. 334. N.

1907. Corbicula fluminalis Müll., Schultze, Aus Namaland u. Kalahari, pp. 616, 708.  $\,N.$ 

1910. Corbicula fluminalis Müll., Bttg., Abh. Senckenb. Ges., xxxii, p. 454. N.

1914. Corbicula fluminalis Müll., Harmer, Pliocene Moll. G.B., i, p. 39. N.L.

1925. Corbicula africana Krs. (=radiata Phil.), Conn., Trans. R. Soc. S. Africa, xii, p. 214. N.

1927. Corbicula radiata Phil., Pilsb. & Beq., Bull. Amer. Mus., N.H., liii, p. 341.  $\,$   $\,$  N.F.

1936. Corbicula africana Krs., Haas, Abh. Senckenb. Ges., No. 431, p. 41. N.

1936. Corbicula fluminalis natalensis Cless., Haas, ibid., p. 42, pl. ii, f. 4. N.F. Synonymy.

Shell of moderate size, subequilaterally trigonal, upper margins nearly straight, basal evenly rounded; fairly solid, umbones smooth, just touching in a closed shell, rest of shell sculptured with close, fairly regular concentric striation, very fine and faint in umbonal region and quickly increasing in coarseness and a trifle more distant with increased growth, though occasionally weaker again near the margins of large specimens; colour dark brown in type, but ranging from pale yellow through almost every shade of olive-brown or green, often in combination on the same valve, while the umbonal region is often prettily rayed with blue or grey and rose or cream. Umbones moderately fine and prominent; breadth usually somewhat exceeding height of shell, though the ratio varies to some extent. Nacre bluish purple, varying in depth, white or pale rose; hinge strong, white and fairly long; hinge plate normally of fair size, cardinal teeth strong, laterals long, thin, nearly equal, very finely serrate, muscle scars but little developed. The largest of the type set measures

Lat. 15, alt. 13, crass. 8·1 mm., and bears about 35 post-nuclear concentric costulae, closer and less strong after the first 16–18; it is about the average size of South African forms, though one of my largest, from Gorongozo District, measures  $20\cdot5\times16\cdot0\times9\cdot3$  mm., being unusually wide in proportion to its height, while another from the Limpopo,  $17\cdot5\times14\cdot7\times9\cdot3$ , runs to the opposite extreme and its costae are coarser than usual, approaching in this respect C. fluminalis (Müll.), and probably forming the basis on which certain authors have grounded their determination of that species from South Africa.

Hab. CAPE PROVINCE. Gauritz R. (type, Krauss); Swellendam (Layard); Gamtoos R. (Farquhar); Port Elizabeth (Crawford).

NATAL (natalensis, Queinzius); Nonoti R. (Miss Brown).

TRANSVAAL. Potchefstroom; Vaal R., Standerton (Miss Livingston); Bodtchabelo (Junod); Limpopo R. (fluminalis, fide Harmer); Krüger Park (Haas).

ZULULAND East (Toppin; Burnup); Mazimba Hill (Haas).

ORANGE FREE STATE. Kroonstad (Miss Hickey).

LORENZO MARQUES. Itschongove (Schenck); Tette (Peters). GRIQUALAND WEST. Riverton, Vaal R. (19×17 mm., Miss

Wilman).

BECHUANALAND. Hartz R., Taungs (Miss Wilman); Witkop (fluminalis, subfossil, Schultze; Rogers); Molopo, Gordonia (Rogers). BRITISH BECHUANALAND. Letter Tree, Botletle R. (Passarge).

LITTLE NAMAQUALAND. Henkries (Lightfoot) and Aughrabies Falls, Orange R. (Barnard).

Types of africana and natalensis in Stuttgart, fluminalis in Copenhagen Museum.

As radiata Phil. is preoccupied, africana takes its place, but the former name simply applied to the variety with radiate umbones, more pronounced, when present, in immature examples, frequently becoming absorbed with increased growth and thickness of the shell, and seldom occurring except in company with the unicoloured form.

The type pair of natalensis Cless. are a large, rather elongate form of africana, nearly uniform dark olive-green, the larger  $19.6 \times 15.8 \times 9.5$  and the smaller  $15.2 \times 13.5 \times 8.7$  mm.; they were collected in Natal by Queinzius and purchased at Stevens in 1863. Two smaller examples of the same form, the larger  $14.8 \times 12.0 \times 7.5$  mm., bear the MS. name of Quinzii Krs. and also africana var. radiata Parr.

This species has a very wide distribution northward, mainly in the region of the great lakes, without, as a rule, greatly exceeding the dimensions given above, but on reaching Egypt what appears to be the same form is hardly, if at all, distinguishable from the large consobrina Caill., which may possibly be conspecific.

The foregoing references are merely to South African forms, without embarking into wider questions of synonymy; the true *C. fluminalis* (Müll.), with which *artini* Plry. is probably synonymous, is a large solid species, more high than broad, which inhabits Asia and North-East Africa.

#### var. albida Krs.

#### Ref. List Nos. 587, 591.

1848. Cyrena africana var. albida (= pusilla Parr.) Krs., Südafr. Moll., pp. 8, 9.  $\, D.$ 

1880. Corbicula oliphantensis Crvn., P.Z.S., p. 618, pl. lvii, f. 12. D.F.

1933. Corbicula oliphantensis Crvn., Ckll., Nautilus, xlvii, p. 77. N. 1936. "albida albida Krs., Haas, Abh. Senckenb. Ges., No. 431, p. 41, pl. ii, f. 3. N.F.

The yellow colour variety of africana, often occurring in company with varicoloured forms, but sometimes apparently retaining its uniform yellow or buff hue in whole colonies without variation. Craven's set were immature, with pretty pale rose nacre, the largest measuring  $12\times10\times6.5$  mm. In the type set of albida, also immature, the majority show this rosy flush on the umbones outside as well as in; a large series from Wilge River are merely white within, and owing doubtless to some chemical in the water, the hinges are extremely weak through erosion, practically absent in the largest shell.

Cockerell (1933) remarks "the shell grows to a larger size, length

18 mm., than Craven indicates, so the distinction from C. africana Krs. may not be valid."

I am not sure, however, whether C. pusilla "Parr." falls into this synonymy.

Hab. TRANSVAAL. R. Lepenula (type, Wahlberg); Wilge R. (Mrs. Wilkinson); Oliphants R. (purchased of Barrett in Bloemfontein, oliphantensis, Craven); 6-mile Spruit and Crocodile R., Pretoria District (Connolly).

S. RHODESIA. Ingezi R., Shangani (Miss A. Mackie).

I only mention localities in which the yellow form appears to remain unmixed, and which suggest headquarters in the Northern Transvaal. Type of albida in Stuttgart, oliphantensis in British Museum.

## Subspecies rosini Haas.

1936. Corbicula albida rosini Haas, Abh. Senckenb. Ges., No. 431, p. 41, pl. iii, f. 2. D.F.

Described as rounded triangular, solid, interior bluish white, exterior straw, with rather distant, fairly deep ribbing, not so broad as the spaces between them. Long. 16, lat. 13, crass. 8 mm.

Distinguished by the straw colour and stronger, more distant ribs.

Hab. S. RHODESIA. Hunyani Drift, 20 km. S. of Salisbury (type, Haas); Zambesi (Brancsik).

Type in Senckenberg Museum.

Also collected by Shortridge in the Upper Zambesi, Barotzeland.

# Corbicula astartina (Mts.).

(Pl. xviii, f. 5–9.)

Ref. List No. 588.

1859. Cyrena astartina Mts., Mal. Blätt., vi, p. 219, pl. iii, f. 6–7. D.F.

1925. Corbicula astartina Mts., Conn., Trans. R. Soc. S. Africa, xii, p. 214. N.

1936. Corbicula astartina Mts., Haas, Abh. Senckenb. Ges., No. 431, p. 42, pl. iii, f. 1. N.F.

A rather coarsely lirate shell, differing in its typical form from africana in being much broader in comparison to its height and far less in cross diameter; the beaks are finer, cardinals closer, shorter and thinner, and the long, nearly straight laterals, which show exceedingly fine serration, far weaker, but the scars are considerably more pronounced than in africana of equal size. All examples known to me are uniform pale yellow, with whitish interior; the concentric costulae vary considerably in distance apart and consequent coarseness. The type is said to measure

Long. 16.0, alt. 11.0, crass. 6.5 mm., and the paratype figured is

" 14·2, " 11·5, " 5·9 ", while other paratypes, with the number of costulae on each shell, measure

> Long. 11.2, alt. 8.5, crass. 4.8 mm., 10 costulae

5.9, ,, 4.7, ,, 3.0 ,,

I set forth the above table at length in order to prove that in typical form, at least, the present species is definitely separable from its confrères.

Hab. LORENZO MARQUES. Tette (type, Peters).

S. RHODESIA. Que Que River (O. Armstrong); Ngamandhlovu (R. H. R. Stevenson).

TRANSVAAL. Great Letaba R., Krüger Park (Haas).

Also recorded from Nyasaland and N. Rhodesia, while what appears to be the same species is rare in Victoria Nyanza.

Type in Berlin Museum.

#### FAMILY SPHAERIIDAE.

Shell small, oval or trigonal, thin, corneous, pallial line simple. Mantle margins united posteriorly to form siphons. Viviparous and hermaphrodite; distribution world-wide.

> Genus Sphaerium Scopoli, 1777 (Intr. Nat. Hist., p. 397) (=Cyclas Brug., 1792).Type Tellina cornea Lin.

Shell ovate, subequilateral, umbones slightly inclined to rear, anterior side rather shorter than posterior, muscle scars not impressed. Foot-sole very extensile, mantle edge and siphonal orifice simple, siphons 2 in number, moderately long, united at their base, the branchial somewhat longer, gills unequal, the outer shorter and fringed.

> Sphaerium capense (Krs.). (Pl. xviii, f. 1-2.)

> > Ref. List No. 593.

1848. Cyclas capensis Krs., Südafr. Moll., p. 7, pl. i, f. 6. D.F. 1878. Sphaerium capense Krs., Sow., Conch. Icon., xx, pl. v, f. 45 a-b. D.F.

1923. Sphaerium capense Krs. and vinosum Sow. (=capense Sow., non Krs.), Dupuis, Ann. Soc. Zool. Belg., liv, p. 21. N.

1927. Sphaerium capense Krs. and vinosum Sow., Pilsb. & Beq., Bull. Amer. Mus. N.H., liii, pp. 347 and 348. Check List.

1936. Sphaerium capense capense Krs., Haas, Abh. Senckenb. Ges., No. 431, p. 44. L. Synonymy.

Shell nearly oval, thin, smooth, pale corneous, with occasional darker bands of growth; all margins evenly arcuate, umbones obtuse and very weak, cardinal teeth scarcely discernible, both anterior and the posterior lateral in right valve strong and projecting, that in left valve very weak; sculpture of extremely weak concentric striolae, only just visible under a lens.

Long. 9.0, alt. 7.0, crass. 5.7 mm.; several paratypes received from Krauss in the British Museum agree in all above details with the type set, in which the freshest and smallest example is pale, slightly yellowish olivaceous.

Hab. CAPE PROVINCE. Knysna River (type, Krauss). ZULULAND. St. Lucia Lake (Haas).

S. RHODESIA. Makabusi Falls, near Salisbury (Miss Weineck). Type of capense in Stuttgart, "vinosum" in British Museum.

In order to dispel once and for all the myth woven around vinosum, it is necessary to quote Sowerby's description of capense in 1878: "Sphaerium capense. Sph. testa subquadratim ovata, tumida, ferruginea, intus subvinosa, fasciata, umbonibus rotundis, latere antice brevi depresso, rotundo, latere postico obscure angulato, obtusissime subquadrato. The vinous Sphaerium. Sow.—Sph. capense Krauss is a more shortly ovate and more compressed lenticular shell than this."

If Sowerby really intended to separate the shell he described from capense, it is impossible to realise what was his conception of Krauss' species, since his description is based on the same shell that I have described above, coated externally with a ferrugineous deposit, which shows through into the interior and causes it to appear the colour of claret; however, Dupuis advanced the theory that Sowerby's title "capense" was a lapsus calami for "vinosum," and that he had intended to publish it under that name, which should accordingly be substituted at the head of his Latin description. I trust that the facts I have stated are sufficient to prove that no further account need be taken of Dupuis' suggestion.

Thiele has recorded this species from Lake Karago in the north-west corner of Tanganyika Territory, and Haas from the Belgian Congo.

Genus Pisidium C. Pfr., 1821

(Syst. Anord. u. Beschr. D.L.-u.W.-Schn., pp. 17, 123)

(=Pisum Gray, 1847, and Fluminina Cless., 1873).

Type Cyclas obliqua Lam. (Tellina amnica Müll.).

Shell small, inequilateral, beaks towards rear, ligament immersed. Lateral teeth double in right, single in left valve, cardinals 2 in each valve, concrescent in right into a single arcuate tooth; siphons separate at ends.

## Pisidium langleyanum M. & P.

Ref. List No. 595.

1891. Pisidium langleyanum M. & P., A.M.N.H., viii, p. 237. D. 1892. ,, ,, ix, p. 94, pl. v, f. 7. F.

Shell very small, nearly oval, umbones rather prominent, sculpture consisting of close, rather fine concentric striae, fairly regular but varying a little in strength and distance. Interior—right valve: upper anterior lateral short and weak, lower obtusely triangular, about twice as long; cardinal very weak; upper posterior lateral extremely weak, lower longer and stronger, very obtusely angulate. Left valve: both laterals short, anterior the stronger, cardinals parallel, angulate, lower the longer.

Lat. 3.0, alt. 2.5 mm.

Hab. CAPE PROVINCE. Port Elizabeth (type, Langley).

ORANGE FREE STATE. Rhenoster R., Rustfontein (Connolly).

Type in British Museum.

The type, described above, is a somewhat immature shell with hinge system poorly developed; a better-grown example from Rustfontein shows similar sculpture and hinge arrangement, but with the right lower lateral more pronounced and right cardinal, which is barely discernible in the type, roughly triangular; left anterior lateral comparatively stronger than in type.

# Pisidium ovampicum Ancey.

Ref. List No. 596.

1890.  $Pisidium\ ovampicum\ Ancey,\ Bull.\ Soc.\ Mal.\ Fr.,\ vii,\ p.\ 162.\ D.$ 

1910. Pisidium cf. langleyanum M. & P. (?), Bttg., Abh. Senckenb. Ges., xxxii, p. 455, pl. xxviii, f. 19. D.F.

1930. Pisidium ovampicum Ancey, Conn., Ann. S.A. Mus., xxix, p. 325. N.

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1932. Pisidium sp. n. (?), juv., Hutch., Pickf. & Schuurm., Arch. f. Hydrob., xxiv, p. 49. L.

Ancey's description runs "nitidula lineis concentricis tenuibus sculpta, ovata, umbones paulo ante medium siti, depressi, vix prominuli. Pars antica rotundata, late arcuata, postica vix minus lata, convexa, haud truncata nec rostrata (convexitas maxima submediana), praecedente paulo major. Valvae medio convexo-depressae.

"Diam.  $2\frac{2}{3}$ , alt.  $2\frac{1}{7}$ , crass.  $1\frac{1}{2}$  mm."

No authentic examples are known of this unfigured species, obviously described from an unopened shell, but a single weathered valve from Damara or Ovamboland appears to agree sufficiently well with its description to warrant the probability of its being conspecific, and it, in turn, appears conspecific with better-grown and preserved specimens from Lake Chrissie; of these, therefore, I offer the following description, with the purely tentative suggestion that they may represent Ancey's lost species.

Shell very small, oval, umbones little prominent, sculpture similar to but stronger than that of langleyanum. Interior—right valve: upper anterior marginal short and weak, lower twice its length and strength; cardinal vestigial; lower posterior marginal somewhat longer and much stronger than upper. Left valve: anterior lateral long and narrow, posterior short and weak, cardinals very weak, especially the upper.

Lat. 3.2, alt. 2.6 mm.

Hab. OVAMBOLAND (type, Andersson & Chapman). TRANSVAAL. Lake Chrissie (Miss E. L. Stephens).

BECHUANALAND. Witkop (langleyanum (?), sub-fossil, Schultze).

Type ubi?.

## Pisidium costulosum Conn.

(Text-fig. 57.)

1931. Pisidium costulosum Conn., A.M.N.H., viii, p. 310, pl. xiii, f. 24–27. D.F.

1936.  $Pisidium\ costulosum\ Conn.$ , Haas, Abh. Senckenb. Ges., No. 431, p. 43. L.

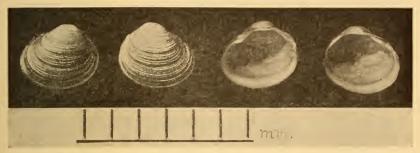
Shell very small, roundly trigonal, the broad prominent umbones smooth, white, and glossy, remainder dull milky white, sculptured with strong, close, coarse, regular, concentric costae; all margins regularly arcuate, posterior very short and steep, anterior about twice as long, with gentler slope and narrower curve.

Interior—right valve: upper anterior lateral very short and narrow, lower short but strong, obtusely triangular; cardinal tooth bluntly rounded; both posterior laterals strong, upper nearly two-thirds as long as lower. Left valve: anterior lateral long, straight and strong; upper cardinal long, straight and narrow,

almost parallel to posterior slope of lower, which is bluntly rounded; posterior lateral weak and narrow.

Lat. 2.95, alt. 2.45 mm.

Hab. ORANGE FREE STATE. Rhenoster R., Rustfontein (Connolly).



Text-fig. 57.—Pisidium costulosum Conn. Type, highly magnified.

TRANSVAAL. Great Letaba R., Krüger Park (Haas).

Type in British Museum.

Easily distinguishable from other South African forms by its strong costulation.

> Genus Bisanodonta Orb., 1846 (Vov. Amer. Merid., p. 622). Type B. paranensis Orb.

(= Eupera Bgt., 1854, Limosina Cless., 1872 and Clessinella Waagen, 1905).

Shell small, very thin, inequilateral, beaks prominent, situate in front of the middle; hinge narrow, with a single small cardinal on each side, or missing on the right; in left valve 1, in right valve 2 laterals fore and aft. Siphons united near base; mantle generally spotted with black.

Bisanodonta ferruginea (Krs.).

(Pl. xviii, f. 3-4.)

Ref. List No. 594.

1848. Cyclas ferruginea Krs., Südafr. Moll., p. 7, pl. i, f. 6. D.F. 1918. Eupera ferruginea Krs., Germ., Bull. Mus. Paris, xxiv, p. 38. N.

1921. Eupera ferruginea Krs., Germ., Faune Mascareignes, p. 404. N.

1922. Sphaerium ferrugineum Krs., Cawst., S. Afr. J. Sci., xix, p. 278. N.

1936. Eupera ferruginea Krs., Haas, Abh. Senckenb. Ges., No. 431, p. 43. L.

Shell small, nearly oval, posterior slope longer and less convex than anterior, nymphs smooth, rest of shell covered with very fine, close and regular concentric striae, slightly coarser and more distant near outer margin; ground colour rather pale chestnut, marginal zone unicoloured, central area and umbonal region densely mottled with black; interior bluish white, the black exterior mottling showing through the shell; cardinals strong, right oblique, extending across hinge plate, left very short, parallel to margin; all laterals very strong, left posterior very short, anterior more than twice as long, right anterior about twice the length of posterior; posterior muscle scars strongly defined, anterior smaller and less so.

Lat. 6.7, alt. 5.0, crass. 3.2 mm.

Hab. CAPE PROVINCE. R. Knysna (type, Krauss).

NATAL. Avoca; Illovo Lagoon (Cawston).

TRANSVAAL. Great Letaba R., Krüger Park (Haas).

S. RHODESIA. Victoria Falls (Connolly).

Type in Stuttgart Museum.

The single example from the Victoria Falls is immature,  $4.6 \times 3.4$  mm., with slightly stronger sculpture than in the type, and approaches in this respect the northern *parasitica* Phil.; its eggs are exceedingly small and just too elongate to be termed circular. The species is also recorded from Madagascar.

Species which have been erroneously attributed to South Africa, or of which the Names May, for Various Reasons, be removed from the List of Authentic South African Varieties.

Note.—It will be seen that the roll now given differs slightly, both by addition and subtraction, from that appended to my Reference List.

### Ceratoconcha schultzei Simroth.

1907. Ceratoconcha schultzei Srth., Zool. Anz. Leipsig, xxxi, p. 794, etc. D.F.

Hab. CAPE PENINSULA. Cape Flats (Schultze).

Böttger has shown that this is the larva of *Microdon* Meig. and consequently has no place in Mollusca.

## Ennea zanguebarica Morel.

1889. Ennea zanguebarica Morel., J. de C., xxxvii, p. 10, pl. i, f. 7. D.F.

Hab. CAPE PROVINCE. Port Elizabeth (fide Morelet).

A synonym of Edentulina obesa Gibb., an East African shell, wrongly attributed to South Africa.

# Rhytida bullacea (Pfr.).

1854. Helix bullacea Pfr., P.Z.S., p. 53. D.

", ", Morel., J. de C., xxxvii, p. 19. L.

Hab. CAPE PROVINCE. Port Elizabeth (fide Morelet).

An Australian, not South African, species.

## Nanina pisolina Gld.

1859. Nanina pisolina Gld., Proc. Boston Soc., vi, p. 423. D.

Hab. "CAPE OF GOOD HOPE?" (Ringold and Rodgers).

As no authentic example of this insufficiently described species can be traced and its original locality is doubtful, it cannot be considered a collectable form.

## Arion fuscus (Müll.).

#### Ref. List No. 209.

1774. Limax fuscus Müll., Verm., ii, p. 11. D.

1900. Arion fuscus Müll., Clige., Ann. S.A. Mus., ii, p. 7. L.

1910. ,, ,, ,, Ann. Natal Mus., ii, p. 170. L.

Hab. CAPE PENINSULA. Cape Town (Lightfoot).

NATAL. Pietermaritzburg (Burnup).

I have shown under A. intermedius (q.v.) that the two South African records given above must be transferred to that species.

# Sculptaria collaris (Pfr.).

#### Ref. List No. 223.

1867. Helix collaris Pfr., Mal. Blätt., xiv, p. 197. D.

1909. Stegodera (Moellendorffia) mariae Nobre, Bull. Soc. Port., iii, Suppl. 2, p. 79. D.

1923. Sculptaria collaris Pfr. (=mariae Nobre), Bnp., Ann. Natal Mus., v, p. 14, pl. i, f. 14-18. D.F.

Burnup proves that the proper habitat of this species is Benguela, Angola, and that it has not yet been found south of the Kunene River.

#### Helix bulbus Pfr.

Ref. List No. 283.

1848. Helix bulbus Mke., Pfr., Zeitschr. f. Malak., v, p. 116. D.

1915. " " " Conn., Ann. S.A. Mus., xiii, p. 177. N.

Hab. CAPE OF GOOD HOPE (in coll. Menke).

Placed by Tryon (1887) in *Dorcasia*, but no authentic example is extant and the shell appears unlike anything known from South Africa.

#### Helix comatula Fér.

1821. Helix (Helicella) comatula Fér., Tabl. Moll., pt. 3, p. 50 (or 46). L.

Hab. CAPE OF GOOD HOPE. On aloes (Delalande).

Nomen nudum.

#### Helix connexiva Fér.

1821. Helix (Helicostyla) connexiva Fér., Tabl. Moll., pt. 3, p. 50 (or 46). L.

Hab. CAPE OF GOOD HOPE (Delalande).

Nomen nudum.

## Helix dolosa Fér.

1821. Helix (Helicostyla) dolosa Fér., Tabl. Moll., pt. 3, p. 50 (or 46). L.

Hab. CAPE OF GOOD HOPE (Delalande).

Nomen nudum.

#### Helix ekloniana Beck.

1837. Helix (Theba) ekloniana Beck., Index Moll., p. 11. L. Hab. "Afr. aust. Alg." (fide Beck).

Nomen nudum.

## Helix familiaris Fér.

1837.  $Helix\ familiaris\ Fér.$ , Cat. Coll. Férussac, p. 6. L. Hab. CAPE OF GOOD HOPE (in coll. Férussac).

Nomen nudum.

## Helix fanulus Pfr.

1856. Helix fanulus Pfr., P.Z.S., p. 33. D.

Hab. PORT NATAL (coll. Cuming).

Type in British Museum.

The tip of a Gulella of the group of adamsiana, q.v.

#### Helix lactea Müll.

Ref. List No. 300.

1774. Helix lactea Müll., Verm., ii, p. 19. D.

1916. ,, faux-nigra Chem., Conn., Ann. S.A. Mus., xiii, p. 187. N.

Hab. CAPE PROVINCE. Kowie (Barber).

The Layard collection contained a mature example of this species which was taken alive, together with a smaller empty shell, in a garden by the Kowie River in 1897; on the sale of that collection they were thrown away as of no interest, but I can affirm that they were of the dark coloration prevalent in some of the Canary Islands, whence they were probably imported into South Africa. The species has not recurred there and is best removed from the local list.

#### Helix monticola Beck.

1837. Helix (Bradybaena) monticola Beck, Index Moll., p. 20. L. Hab. CAPE OF GOOD HOPE (fide Beck).

Nomen nudum.

Helix sectilis Fér.

1821. Helix (Helicella) sectilis Fér., Tabl. Moll., pt. 3, p. 46 (or 42). L.

Hab. CAPE PROVINCE. Caffraria (Delalande).

Nomen nudum.

Rachis picturata (Morel.).

1889. Bulimus picturatus Morel., J. de C., xxxvii, p. 7, pl. i, f. 4. D.F.

Sturany (1898) attributed this species in error to Port Elizabeth; it was described from Central Africa.

#### Pupa haploa M. & P.

1893. Pupa haploa M. & P., A.M.N.H., xi, p. 21, pl. iii, f. 7. D.F. Hab. TRANSVAAL. Pretoria (fide M. & P.).

#### Pupa psichion M. & P.

1894. Pupa psichion M. & P., A.M.N.H., xiv, p. 93, pl. i, f. 8. D.F.

Hab. TRANSVAAL. Pretoria (fide M. & P.).

I showed in 1912 that both the foregoing should be regarded as irrevocably lost, though probably also redundant species.

## Curvella disparilis (Smith).

1890. Bulimus (Hapalus) disparilis Smith, A.M.N.H., vi, p. 156, pl. v, f. 13. D.F.

1925. Curvella disparilis Smith, Conn., Trans. R. Soc. S. Africa, xii, p. 183. L.

Since I recorded this species from three localities in Portuguese East Africa mature consideration has caused me to attribute the examples to my new var. *smithi* of *Curvella nyasana* Smith rather than to his other species.

## Rumina decollata (Lin.).

1758. Helix decollata Lin., Syst. Nat., Ed. 10, i, p. 773. D.

1916. Rumina decollata Lin., Conn., Ann. S.A. Mus., xiii, p. 189. N.

Hab. CAPE PROVINCE. Port Elizabeth (coll. Layard).

I showed in 1912 that there is no evidence that this species ever occurred in live condition in the sub-continent.

## Auriculastra pellucens (Mke.).

1830. Auricula pellucens Mke., Syn. Méth. Moll., p. 131. D.

Krauss attributed to this South American species shells collected by Wahlberg in Natal; they are A. radiolata Morel. (=durbanica M. & P.).

# Auriculastra pusilla (Ads.).

1854. Ellobium pusillum Ads., P.Z.S., p. 8. D.

Hab. NATAL. Cato's Creek, Durban.

It is probable that the record of this Philippine species from Natal, based on a single specimen, is incorrect.

# Planorbis caffer "Krauss."

1889. P. caffer Krs., Morel., J. de C., xxxvii, p. 19. L.

Hab. CAPE PROVINCE. Port Elizabeth (fide Morelet).

A non-existent species, possibly a misprint for *U. caffer* Krs., which is known from Port Elizabeth, but not included in Morelet's list of species from that district.

## Planorbis rüppellii Dkr.

Ref. List No. 502.

1848. Planorbis rüppellii Dkr., P.Z.S., p. 42. D.

rüppelli Krs., Junod, Bull. Soc. Vaudoise, xxxv, 1900. p. 279. L.

Hab. LORENZO MARQUES. Rikatla (Junod).

Junod's record of this Abyssinian species refers to pfeifferi Krs.

## Bulinus contortus (Mich.).

## Ref. List No. 518.

1829. Physa contorta Mich., Bull. Soc. Linn. Bordeaux, iii, p. 268, plate, f. 15-16. D.F.

1916. Isidora contorta Mich., Conn., Ann. S.A. Mus., xiii, p. 190. N.

1931. Bulinus contortus Mich., Beq. & Clench, Occ. Pap. Boston Soc. N.H., v, p. 360. N.

Hab. CAPE PROVINCE. Quarry near Fort England, Grahamstown (Farquhar).

I agree fully with Bequaert and Clench that very much exhaustive research is advisable before admitting the existence of this circum-Mediterranean species in South Africa, though it is certainly very near akin to the southern B. tropicus on conchological grounds.

#### Bulinus schackoi and sericina (Jickeli).

1874. Isidora schackoi and sericina Jick., Fauna N.-O.-A., pp. 197, 194, pl. vii, f. 12, 11. D.F.

1898. Physa schackoi and sericina Jick., M. & P., Proc. Mal. Soc., iii, p. 182. L.

Hab. SOUTH AFRICA (sericina) and 48 miles from Port Elizabeth (schackoi, in coll. Ponsonby).

Here again, there is insufficient reason for dragging Abyssinian species into the South African list when the local forms fall well within the limits of B. tropicus.

## Cyclotus natalensis Pfr.

1861. Cyclotus natalensis Pfr., P.Z.S., p. 388. D.

" " " M. & P., A.M.N.H., iv, p. 193. N.

Hab. CAPE NATAL (coll. Cuming).

Type in British Museum.

"Cyclotus natalensis Pfr. has been shown by Ancey to be the Cyclophorus klobukowskii Morlet from Tonkin and must therefore be removed from South African list." (M. & P.)

## Cyclostoma goudotianum Sow.

1847. Cyclostoma goudotianum Sow., Thesaurus Conch., i, p. 130, pl. xxix, f. 193. D.F.

The type in the British Museum is labelled "Natal," but the species is Madagascan, not South African, and the locality is almost certainly erroneous.

## Cyclostoma letourneuxi Bgt.

1889. Cyclostoma letourneuxi Ancey, Bgt., Moll. de l'Afr. Équat., p. 152. D.

Kobelt records this species from "South-East Africa," but it is not yet known from south of the Zambesi.

## Cyclostoma zanguebaricum Petit.

1850. Cyclostoma zanguebaricum Petit, J. de C., i, p. 53, pl. iii, f. 5. D.F.

1854. Cyclostoma parvispirum Pfr., P.Z.S., p. 128. D.

Erroneously recorded by Morelet (1889) from Port Elizabeth; not yet known from south of the Zambesi.

# Thiara amarula (Lin.).

#### Ref. List No. 554.

1758. Helix amarula Lin., Syst. Nat., Ed. 10, i, p. 774. D.

The two Natalian records of this species given in my Reference List can safely be transferred to T. vouamica Bgt.

#### Melania histrionica Rve.

1860. Melania histrionica Rve., Conch. Icon., pl. xxix, f. 192. D.F.

Hab. CAPE COLONY (coll. Cuming).

Type in British Museum.

A west coast species probably attributable to *M. aurita* Müll. or *balteata* Phil., of which the presence in South Africa lacks confirmation.

## Melanopsis princeps Lea.

1837. Melanopsis princeps Lea, Trans. Amer. Phil. Soc., v, p. 82, pl. xix, f. 74. D.F.

Hab. CAPE OF GOOD HOPE (fide Lea).

Placed by Brot, 1879, in the synonymy of Faunus ater (Lin.); Lea's locality is erroneous.

## Neritina crepidularia Lam.

1822. Neritina crepidularia Lam., Hist. Nat. An. s. Vert., vi, 2, p. 186. D.

1848. Neritina crepidularia Lam., Krs., Südafr. Moll., p. 88. D.N. 1899. ,, ,, ,, M. & P., A.M.N.H., iv, p. 194. N.

Hab. NATAL coast (Wahlberg).

Krauss expresses some doubt as to the correctness of the above determination. M. & P. remark: "This species has been found in Ashanti, but we have not met with it at present from South Africa."

## Unio lechaptoisi Ancey.

1894. Unio lechaptoisi Ancey, Mem. Soc. Zool. Fr., vii, p. 228, f. 3. D.F.

1897. Unio lechaptoisi Ancey, Mts., D.O.A., iv, p. 226. D.

1900. Nodularia lechaptoisi Ancey, Simpson, Proc. U.S. Nat. Mus., xxii, p. 823. Check List.

1910. Unio shireensis Prest., A.M.N.H., vi, p. 61, pl. iv, f. 11. D.F.

1914. Unio shireensis Prest., Simpson, Cat. Naiades, p. 727. D.

" Nodularia lechaptoisi Ancey, Simpson, ibid., p. 1037. D.

1922. Unio lechaptoisi Ancey (=shireensis Prest.), Dupuis, Ann. Soc. Zool. Belg., liii, p. 82. N.

The British Museum possesses this species collected by Quekett in the Upper Zambesi, presumably in Northern Rhodesia, and a single complete specimen in fine condition, said to have been collected by Kirk "near Mazzara, R. Zambesi" (Masare, Lorenzo Marques). There is no particular reason to doubt the accuracy of this record, but as the species has not appeared within South African boundaries since 1858, and then only in a single example, it may be better to introduce it here in the doubtful list than include it among those of which the occurrence within our limits may be considered well proven. Haas (1936) considers it identical with *U. mossambicensis*, but this fact appears to me somewhat open to question.

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metuloides (Smith), Edouardia         433           míongosiensis Bnp., Gulella         90           micans Pfr. (Bulimus)         337           microbus Morel. (Pupa)         375           Microbekus, GA.         132           MICROFEAS Conn.         355           microscopica (Krs.), Trach.         224           MICROSTELE Bttg.         398           microstriata Prest., Trach.         214           microthauma M. & P. (Ennea)         95           MILAX Gray         180           minimus M. & P. (Cyclophorus)         540           minimus Stth. (Arion)         182           minor Pollon., Oopelta         187           minor Pfr., var.         543           minor Pfr., var.         543           minor Dgnr., var.         262           minor Dgnr., var.         262           minor Morel., Gulella         44           minor Dgnr., var.         262           minuta (Morel.), Gulella         44           minuta (Drap., (Limneus)         481           minuta (Morel.), Gulella         44           minuta (Drap.)         481           minuta (Drap.)         481           minuta (Drap.)         481				
micans Pfr. (Bulimus)         337           microbus Morel. (Pupa)         375           microbus Morel. (Pupa)         375           microbersus, GA.         132           microscopiea (Krs.), Trach.         224           microstrela Bttg.         398           microstriata Prest., Trach.         214           microthauma M. & P. (Ennea)         95           MLAX Gray         180           miniata (Krs.), Gulella         31           minimus M. & P. (Cyclophorus)         540           minimus Srth. (Arion)         182           minor Pollon., Oopelta         187           minor Pfr., Nata         100           minor Pfr., var.         543           minor Bttg., var.         543           minor Dgnr., var.         542           minor Junod, var.         262           minor Junod, var.         323           minuta (Morel.), Gulella         44           minuta Smith (Thapsia)         125           modesta Lea (Spatha)         618           modesta Conn., Curvella         365           minuta (Morel.), Fulcella         45           minuta (Morel.) (Planorbis)         490           mixta Smith (Thapsia)         151			nana (Walk.), Burnupia	
micans Pfr. (Bulimus)         337           microbus Morel. (Pupa)         375           microbus Morel. (Pupa)         375           microbersus, GA.         132           microscopiea (Krs.), Trach.         224           microstrela Bttg.         398           microstriata Prest., Trach.         214           microthauma M. & P. (Ennea)         95           MLAX Gray         180           miniata (Krs.), Gulella         31           minimus M. & P. (Cyclophorus)         540           minimus Srth. (Arion)         182           minor Pollon., Oopelta         187           minor Pfr., Nata         100           minor Pfr., var.         543           minor Bttg., var.         543           minor Dgnr., var.         542           minor Junod, var.         262           minor Junod, var.         323           minuta (Morel.), Gulella         44           minuta Smith (Thapsia)         125           modesta Lea (Spatha)         618           modesta Conn., Curvella         365           minuta (Morel.), Fulcella         45           minuta (Morel.) (Planorbis)         490           mixta Smith (Thapsia)         151			nana Conn., var	
microbus Morel. (Pupa)         375           Microberkus, GA.         132           Microbersas Conn.         355           microscopica (Krs.), Trach.         224           Microstell Bttg.         398           microstriata Prest., Trach.         214           microthauma M. & P. (Ennea)         95           MILAX Gray         180           miniata (Krs.), Gulella         31           minimus Srth. (Arion)         182           minor Pollon., Oopelta         187           minor (Pfr.), Nata         100           minor Pfr., var.         543           minor Btg., var.         274           minor Dgnr., var.         326           minor Dgnr., var.         322           minor Junod, var.         322           minuta (Morel.), Gulella         44           minuta Worel. (Planorbis)         481           minuta Worel. (Planorbis)         481           minuta Smith (Thapsia)         151           modesta Lea (Spatha)         618           Mol	mfongosiensis Bnp., Gulella	90	NATA Wats	
Microkerkus, GA.         132         natalensis (Pfr.), Edouardia atalensico proposition of the procession of the	micans Pfr. (Bulimus)	337	natalensis (Crvn.), Gulella	24
Microckerkus, GA.         132         natalensis (Pfr.), Edouardia         422           Microsofica (Krs.), Trach.         224         natalensis Pfr., Achatina         307           microstriata Prest., Trach.         214         natalensis Krs., Lymnaea         476           microstriata Prest., Trach.         214         natalensis Krs., Veronicella         450           microstriata Prest., Trach.         214         natalensis Krs., Planorbis         490           minata (Krs.), Gulella         31         natalensis Krs., Planorbis         490           minimus Srth. (Arion)         182         natalensis Walk., Ferrissia         529           minor Pollon., Oopelta         187         natalensis Com., Tomichia         586           minor Pfr., var.         543         natalensis Morel. (Ennea)         73           minor Dgn., var.         262         natalensis Fr. (Velotus)         633           minor Dgn., var.         262         natalensis Enp. (Obeliscus)         337           minuta (Morel.), Gulella         44         natalensis Krs. (Vitrina)         133         natalensis Krs. (Vitrina)         133         natalensis Krs. (Vitrina)         133         natalensis Krs. (Vitrina)         133         natalensis Krs. (Vitrina)         132         natalensis Krs. (Vitrina)         132	microbus Morel. (Pupa)	375	natalensis (Pfr.), Sheldonia	130
MICROFEAS Conn.   355   microsopica (Krs.), Trach.   224	Microkerkus, GA	132	natalensis (Pfr.), Edouardia .	422
microscopica (Krs.), Trach.         224         natalensis Krs., Lymnaea         476           Microstele Bttg.         398         natalensis Krs., Veronicella         450           microtifauma M. & P. (Ennea)         95         natalensis Krs., Planorbis         490           Millax Gray         180         natalensis Krs., Bulinus         497           Millax Gray         180         natalensis Krs., Bulinus         497           minata Krs.), Gulella         31         natalensis Krs., Bulinus         497           minor Bttg.         187         natalensis Krs., Bulinus         497           minor Dollon., Oopelta         187         natalensis Krs., Bulinus         497           minor Pfr., Nata         100         natalensis Krs., Bulinus         497           minor Dollon., Oopelta         187         natalensis Krs., Weritina         586           minor Bttg., var.         254         natalensis Com., Tomichia         586           minor Bttg., var.         383         337         natalensis Krs. (Vitrina)         133           minor Dgnr., var.         262         minor Dgnr., var.         328         natalensis Krs. (Cylotus)         337           minor Dgnr., var.         328         minutalensis Lea (Unio)         606	MICROPEAS Conn	355		307
MICROSTELE Šttg.   398   microstriata Prest., Trach.   214   microthauma M. & P. (Ennea)   95   MILAX Gray   180   matalensis Krs., Bulinus   497   MILAX Gray   180   matalensis Krs., Bulinus   498   Matalensis Krs., Corbicula   497   Matalensis Krs., Bulinus   498   Matalensis Krs., Corbicula   599   matalensis Krs., Corbicula   586   Matalensis Krs., Corbicula   586   Matalensis Morel. (Ennea)   73   matalensis Morel. (Ennea)   73   matalensis Krs. (Orbicula)   633   matalensis Krs. (Vitrina)   133   matalensis Krs. (Vitrina)   134   matalensis Krs. (Vitrina)   134   matalensis Morel. (Ennea)   73   matalensis Krs. (Vitrina)   134   matalensis Krs., Vitrina   134   matalensis Marel. (Ennea)   73   matalensis Krs. (Vitrina)   134   matalensis Krs., Vitrina   134   matalensis Krs., Vitrina   134   matalensis Marel. (Ennea)   73   matalensis Krs. (Vitrina)   134   matalensis Krs., Vitrina   134   matalensis Krs. (Vitrina   1				476
microthauma M. & P. (Ennea)         95           mintax Gray         .         180           miniata (Krs.), Gulella         31           minimus S. Krs. (Sulella         31           minor Pollon., Oopelta         187           minor Pollon., Oopelta         187           minor Pfr., Var.         543           minor Btrg., var.         274           minor Bs., varr.         383, 537           minor Dgnr., var.         262           minor Junod, var.         323           minusculus (Mouss.), Pupoides         396           minuta (Morel.), Gulella         44           minythodes M. & P. (Zingis)         125           modesta Conn., Curvella         365           modesta Conn., Curvella         365           montana M. & P. (Ennea)         45           monticola Beck (Helix)         631           monticola Beck (Helix)         631           morelli Prest., Cleopatra         562           mossambicensis (Tr., (Martensia)         157           mosambicensis (Pfr.), Ledoulxia         157           mozambicensis (Pfr.), Ledoulxia         157           mozambicensis (Pfr.), Ledoulxia         157           mozambicensis (Pfr.), Ledoulxia         157			natalensis Krs., Veronicella	
microthauma M. & P. (Ennea)         95           mintax Gray         .         180           miniata (Krs.), Gulella         31           minimus S. Krs. (Sulella         31           minor Pollon., Oopelta         187           minor Pollon., Oopelta         187           minor Pfr., Var.         543           minor Btrg., var.         274           minor Bs., varr.         383, 537           minor Dgnr., var.         262           minor Junod, var.         323           minusculus (Mouss.), Pupoides         396           minuta (Morel.), Gulella         44           minythodes M. & P. (Zingis)         125           modesta Conn., Curvella         365           modesta Conn., Curvella         365           montana M. & P. (Ennea)         45           monticola Beck (Helix)         631           monticola Beck (Helix)         631           morelli Prest., Cleopatra         562           mossambicensis (Tr., (Martensia)         157           mosambicensis (Pfr.), Ledoulxia         157           mozambicensis (Pfr.), Ledoulxia         157           mozambicensis (Pfr.), Ledoulxia         157           mozambicensis (Pfr.), Ledoulxia         157	microstriata Prest Trach		natalensis Krs Planorhis	
MILAX Gray         180         natalensis Walk., Ferrissia         529           minimus M. & P. (Cyclophorus)         540         natalensis Rve., Neritina         599           minimus Srth. (Arion)         182         natalensis Rve., Neritina         599           minor Pollon., Oopelta         187         natalensis Rve., Neritina         598           minor Pollon., Oopelta         187         natalensis Clige. (Apera)         10           minor Pfr., Nata         100         natalensis Morel. (Ennea)         73           minor Pfr., var.         543         natalensis Morel. (Ennea)         33           minor Btg., var.         274         natalensis Morel. (Ennea)         33           minor Dgnr., var.         262         natalensis Fr. (Vitrina)         133           minor Dgnr., var.         262         natalensis Fr. (Cyclotus)         633           natalensis Walk., Str. (Vitrina)         133         natalensis Walk., var.         632           minor Dgnr., var.         262         natalensis Walk., var.         632           minor Dgnr., var.         262         natalensis Walk., Str. (Vitrina)         133           natalensis Walk., Str. (Vitrina)         133         natalensis Walk., Str. (Vitrina)         134           minus Gulus (Mous.), Pupoi				
miniata (Krs.), Gulella         31         natalensis Rve., Neritina         599           minimus M. & P. (Cyclophorus)         540         natalensis Conn., Tomichia         586           minor Pollon., Oopelta         187         natalensis Conn., Tomichia         586           minor Pollon., Oopelta         187         natalensis Cllge. (Apera)         10           minor Pfr., Var.         543         natalensis Bnp. (Obeliscus)         337           minor Bttg., var.         274         natalensis Krs. (Vitrina)         133           minor Dgnr., var.         262         natalensis Lea (Unio)         606           minor Junod, var.         323         natalensis Lea (Unio)         606           minusculus (Mouss.), Pupoides         396         natalensis Krs. (Vitrina)         133           minor Junod, var.         323         natalensis Krs. (Vitrina)         633           minuta (Morel.), Gulella         44         natalensis Walk., (Vitrina)         631           minuta Drap. (Limneus)         481         natalensis Walk., var.         522           minuta (Morel.), Gulella         441         natalensis Walk., var.         522           minuta (Morel.), Gulella         365         NATALINA Pilsb.         103           misellus Morel. (Planorbis)				
minimus M. & P. (Cyclophorus)         540         natalensis Conn., Tomichia         586           minimus Srth. (Arion)         182         natalensis Conn., Tomichia         586           minor Pollon., Oopelta         187         natalensis Gonn., Tomichia         73           minor Pfr., Nata         100         natalensis Gonn., Tomichia         73           minor Pfr., var.         543         natalensis Gonn., Tomichia         73           minor Pfr., var.         543         natalensis Gonn., Tomichia         73           minor Pfr., var.         543         natalensis Conn., Tomichia         73           minor Pfr., var.         543         natalensis Conn., Correlation.         73           minor Bttg., var.         254         natalensis Bnp. (Obeliscus)         337           nator Bttg., var.         254         natalensis Frs. (Vitrina)         133           minor Dgnr., var.         262         natalensis Pfr. (Cyclotus)         633           minus culus (Mouss.), Pupoides         396         natalensis Lea (Unio)         606           minuta (Morel.), Gulella         44         natalensis Krs. (Vitrina)         617           minuta (Morel.), Gulella         44         natalensis Male., var.         522           minuta (Morel.), Gulella				
minimus Srth. (Arion)         182         natalensis Clige. (Apera)         10           minor (Pfr.), Oopelta         187         natalensis Morel. (Ennea)         73           minor (Pfr.), Nata         100         natalensis Morel. (Ennea)         33           minor Pfr., var.         543         natalensis Bnp. (Obeliscus)         337           minor Bs., varr.         383, 537         natalensis Krs. (Vitrina)         133           minor Dgnr., var.         262         natalensis Lea (Unio)         606           minor Junod, var.         323         natalensis Lea (Unio)         606           minuta (Morel.), Gulella         44         natalensis Krs. (Corbicula)         619           minuta (Morel.), Gulella         44         Natalia GA.         535           minuta (Morel.), Gulella         45         Natalia GA.         535           minuta (Morel.), Gulella         365         Natalia GA.         54				
minor Pollon., Oopelta         187           minor (Pfr.), Nata         100           minor Pfr., var.         543           minor Bttg., var.         274           minor Bs., varr.         383, 537           minor Dgnr., var.         262           minor Junod, var.         323           minusculus (Mouss.), Pupoides         396           minuta (Morel.), Gulella         44           minuta Drap. (Limneus)         481           minythodes M. & P. (Zingis)         125           misellus Morel. (Planorbis)         490           mixta Smith (Thapsia)         151           modesta Conn., Curvella         365           modesta Lea (Spatha)         618           MOLLUSCA         5           montana M. & P. (Ennea)         45           montana Conn., var.         276           monteola Beck (Helix)         631           morrumbalensis (M. & P.), Zingis         153           mosambiquensis Cless., Physa         475           mossambicensis "Pfr." (Martensia)         157           mossambicensis Sttr. (Buliminus)         329           mozambicensis (Pfr.), Ledoulxia         157           mozambicensis (Pfr.), Ledoulxia         157 <t< td=""><td></td><td></td><td>natalensis Conn., Tomichia .</td><td></td></t<>			natalensis Conn., Tomichia .	
minor (Pfr.), Nata         100         natalensis Bnp. (Öbeliscus)         337           minor Pfr., var.         543         natalensis Krs. (Vitrina)         133           minor Bttg., var.         274         natalensis Ffr. (Cyclotus)         633           minor Bs., varr.         383, 537         natalensis Lea (Unio)         606           minor Dgnr., var.         262         natalensis Lea (Spatha)         617           minor Junod, var.         323         natalensis Lea (Spatha)         618           minuta (Morel.), Gulella         44         Natalias Walk., var.         522           minuta Drap. (Limneus)         481         natalensis Walk., var.         522           minuta Drap. (Limneus)         481         natalica Bgt. (Physa)         497           misellus Morel. (Planorbis)         490         NATALINA Pilsb.         103           misellus Morel. (Planorbis)         490         NATALINA Pilsb.         103           modesta Conn., Curvella         365         NATALINA Pilsb.         103           modesta Lea (Spatha)         618         Navicella Lam.         601           modesta Lea (Spatha)         618         NERITIDAE         598           montana M. & P. (Ennea)         45         NERITIDAE         598				
minor Pfr., var.         543         natalensis Krs. (Vitrina)         133           minor Bttg., var.         274         natalensis Pfr. (Cyclotus)         633           minor Bst., var.         383, 537         natalensis Lea (Unio)         606           minor Dgnr., var.         262         natalensis Lea (Spatha)         617           minus Qulus (Mouss.), Pupoides         396         natalensis Krs. (Corbicula)         619           minus (Morel.), Gulella         44         Natalia GA.         522           minuta Drap. (Limneus)         481         natalensis Walk., var.         497           Malailia GA.         535         natalensis Car.         535           minuta Drap. (Limneus)         365         natalensi				
minor Bttg., var.         274         natalensis Pfr. (Cyclotus)         633           minor Bs., varr.         383, 537         natalensis Lea (Unio)         606           minor Dgnr., var.         262         natalensis Lea (Spatha)         617           minor Junod, var.         323         natalensis Krs. (Corbicula)         618           minuta (Morel.), Gulella         44         natalensis Walk., var.         522           minuta Drap. (Limneus)         481         natalica Bgt. (Physa)         497           minythodes M. & P. (Zingis)         125         Natalina Bgt. (Physa)         497           misellus Morel. (Planorbis)         490         NATALINA Pilsb.         103           misellus Morel. (Planorbis)         490         NATALINA Pilsb.         103           misellus Morel. (Planorbis)         490         NATALINA Pilsb.         103           misellus Smith (Thapsia)         151         NATALINA Pilsb.         102           Modasta Lea (Spatha)         618         Natella Wats.         102           MOLLUSCA         5         NERITIDAE         598           montana Conn., var.         276         NESOPUPA Pilsb.         408           morrumbalensis (Ms. & P.), Zingis         153         nitida Drap. (Helix)         170				
minor Bs., varr.         383, 537         natalensis Lea (Unio)         606           minor Dgnr., var.         262         natalensis Lea (Spatha)         617           minus Junod, var.         323         natalensis Krs. (Corbicula)         617           minus (Mouss.), Pupoides         396         natalensis Krs. (Corbicula)         618           minuta Drap. (Limneus)         481         natalia GA.         535           minuth Drap. (Limneus)         481         natalia GA.         535           minythodes M. & P. (Zingis)         125         NATALINA Pilsb.         103           misellus Morel. (Planorbis)         490         NATELLA Wats.         102           modesta Conn., Curvella         365         Nartella Wats.         102           MOLABELLA Conn.         71         Navicella Lam.         601           MOLLUSCA         5         NERITIDAE         598           montana Conn., var.         276         NESOPUPA Pilsb.         408           monticola Beck (Helix)         631         NESOPUPINAE         407           mooiensis (Walk.), Burnupia         523         milotica (Pfr.), Burtoa         296           morrumbalensis Mts., Unio.         610         nitida Drap. (Helix)         170	minor Pfr., var			
minor Dgnr., var.         262         natalensis Lea (Spatha)         617           minor Junod, var.         323         antalensis Krs. (Corbicula)         619           minuta (Morel.), Gulella         44         yatalia GA.         522           minuta Drap. (Limneus)         481         natalensis Walk., var.         522           minuta Drap. (Limneus)         481         natalica Bgt. (Physa)         497           minuta Drap. (Limneus)         481         natalica Bgt. (Physa)         497           minuta Smith (Thapsia)         151         NATALINA Pilsb.         103           mista Smith (Thapsia)         151         NATELLA Wats.         102           modesta Conn., Curvella         365         Navicella Lam.         601           modesta Lea (Spatha)         618         navigioliformis Lea (Unio)         607           molatili Smith (Thapsia)         51         NERITIDAE         598           montana M. & P. (Ennea)         45         NERITIDAE         598           montana Conn., var.         276         NESOPUPA Pilsb.         408           moriciola Beck (Helix)         631         NESOPUPINAE         407           moiensis (Walk.), Burnupia         523         nigra Phil. (Auricula)         466 <tr< td=""><td>minor Bttg., var</td><td></td><td></td><td></td></tr<>	minor Bttg., var			
minor Junod, var.         323         natalensis Krs. (Corbicula)         619           minusculus (Mouss.), Pupoides         396         natalensis Walk., var.         522           minuta (Morel.), Gulella         44         Natalia GA.         535           minuta Drap. (Limneus)         481         natalica Bgt. (Physa)         497           minythodes M. & P. (Zingis)         125         NATALINA Pilsb.         103           misellus Morel. (Planorbis)         490         NATALINA Pilsb.         103           mixta Smith (Thapsia)         151         NATELLA Wats.         102           modesta Conn., Curvella         365         Navicella Lam.         601           modesta Lea (Spatha)         618         Natilia Lam.         607           MOLARELLA Conn.         71         nous vigioliformis Lea (Unio)         607           montana M. & P. (Ennea)         45         NERITIDAE         598           montana Conn., var.         276         NESOPUPA Pilsb.         408           monticola Beck (Helix)         631         NESOPUPINAE         407           moiensis (Bap.), Gulella         562         nitida Orfr.), Jurtoa         296           morrumbalensis (M. & P.), Zingis         153         nilotica (Pfr.), Burtoa         296 <td>minor Bs., varr 383</td> <td>, 537</td> <td></td> <td></td>	minor Bs., varr 383	, 537		
minusculus (Mouss.), Pupoides         396         natalensis Walk., var.         522           minuta (Morel.), Gulella         44         Natalia GA.         522           minuta Drap. (Limneus)         481         natalica Bgt. (Physa)         497           minythodes M. & P. (Zingis)         125         NATALINA Pilsb.         103           misellus Morel. (Planorbis)         490         NATALINA Pilsb.         102           modesta Conn., Curvella         365         Natella Wats.         102           modesta Lea (Spatha)         618         Natella Wats.         102           MOLLUSCA         5         NERITIDAE         598           montana M. & P. (Ennea)         45         NESOPUPA Pilsb.         408           moricola Beck (Helix)         631         NESOPUPINAE         407           moiensis (Walk.), Burnupia         523         nilotica (Pfr.), Burtoa         296      <	minor Dgnr., var	262		617
minusculus (Mouss.), Pupoides         396         natalensis Walk., var.         522           minuta (Morel.), Gulella         44         Natalia GA.         522           minuta Drap. (Limneus)         481         natalica Bgt. (Physa)         497           minythodes M. & P. (Zingis)         125         NATALINA Pilsb.         103           misellus Morel. (Planorbis)         490         NATALINA Pilsb.         102           modesta Conn., Curvella         365         Natella Wats.         102           modesta Lea (Spatha)         618         Natella Wats.         102           MOLLUSCA         5         NERITIDAE         598           montana M. & P. (Ennea)         45         NESOPUPA Pilsb.         408           moricola Beck (Helix)         631         NESOPUPINAE         407           moiensis (Walk.), Burnupia         523         nilotica (Pfr.), Burtoa         296      <	minor Junod, var	323	natalensis Krs. (Corbicula)	619
minuta Drap. (Limneus)         481         natalica Bgt. (Physa)         497           minythodes M. & P. (Zingis)         125         Natalina Pilsb.         103           misellus Morel. (Planorbis)         490         Natalina Pilsb.         103           misellus Smith (Thapsia)         151         Natella Wats.         102           modesta Conn., Curvella         365         Navicella Lam.         601           modesta Lea (Spatha)         618         navigioliformis Lea (Unio)         607           MOLLUSCA         5         NERITIDAE         598           montana M. & P. (Ennea)         45         NESOPUPINAE         598           montana Conn., var.         276         NESOPUPINAE         407           mooiensis (Bnp.), Gulella         56         nigra Phil. (Auricula)         466           mooiensis (Walk.), Burnupia         523         nigra Phil. (Auricula)         466           morrumbalensis (M. & P.), Zingis.         153         nigropunctata Mörch, Oopelta         184           morsambicensis Mts., Unio.         610         nitidas Drap. (Helix)         170           mossambicensis Mts., Unio.         610         nontiensis M. & P. (Ennea)         41           mossambicensis Stur. (Buliminus)         329         nonticiola Bs.,	minusculus (Mouss.), Pupoides .	396		522
minuta Drap. (Limneus)         481         natalica Bgt. (Physa)         497           minythodes M. & P. (Zingis)         125         Natalina Pilsb.         103           misellus Morel. (Planorbis)         490         Natalina Pilsb.         103           misellus Smith (Thapsia)         151         Natella Wats.         102           modesta Conn., Curvella         365         Navicella Lam.         601           modesta Lea (Spatha)         618         navigioliformis Lea (Unio)         607           MOLLUSCA         5         NERITIDAE         598           montana M. & P. (Ennea)         45         NESOPUPINAE         598           montana Conn., var.         276         NESOPUPINAE         407           mooiensis (Bnp.), Gulella         56         nigra Phil. (Auricula)         466           mooiensis (Walk.), Burnupia         523         nigra Phil. (Auricula)         466           morrumbalensis (M. & P.), Zingis.         153         nigropunctata Mörch, Oopelta         184           morsambicensis Mts., Unio.         610         nitidas Drap. (Helix)         170           mossambicensis Mts., Unio.         610         nontiensis M. & P. (Ennea)         41           mossambicensis Stur. (Buliminus)         329         nonticiola Bs.,	minuta (Morel.), Gulella	44	Natalia GA	535
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# EXPLANATION OF PLATES.

		PLATE I.
FIG.		
1.	Gulella	ingens (Stur.), type in Vienna Museum, ×3.
2.	,,	digitalis Conn., type in British Museum, $\times 3\frac{1}{2}$ .
3.	,,	cairnsi (M. & P.), topotype, ×4.
4.	, 5	separata Stur., Margate, ×6.
5.	,,	elliptica (M. & P.), var. caelatior Conn., type, ×6.
6.	,,	infans (Crvn.), Pietersburg, ×4.
7.	,,	perplexa Conn., type in British Museum, ×6.
8.	,,	puzeyi Conn., type in British Museum, ×4.
9.	,,	lissophanes (M. & P.), type in British Museum, ×3
10.	,,	pfeifferi (Krs.), type in Stuttgart Museum, ×5.
11.	,,	tripodium Conn., type in South African Museum, x
12.	,,	claustralis Conn., type in British Museum, ×10.

13. ,, tridens Conn., type in British Museum, ×3.
14. ,, var. intermedia Conn., type in British Museum, ×4.

⟨8.

- 15. ,<br/>, menkeana (Pfr.), paratype from coll. Albers ex Shuttleworth, in Berlin Museum,<br/>  $\times 1.$
- 16. ,, perissodonta (Stur.), type in Vienna Museum, ×4.

# PLATE II.

- 1. Gulella caryatis (M. & P.), var. diabensis Conn., type in Berlin Museum,  $\times 6\frac{2}{3}$ .
- 2. ,, pondoensis Conn., type in British Museum, ×2.
- 3. , fraudator Conn., type in British Museum, ×8.
- 4. ,, aprosdoketa Conn., type in British Museum, ×6.
- 5-7. Natalina reenenensis Conn., type in British Museum, ×1.
  - 8. ,, ,, apical sculpture, enlarged.
- 9-11. Nata minor (Pfr.), original in Stockholm Museum,  $\times 2$ .
- 12–14. Gudeëlla pinguis (Krs.), type in Stuttgart Museum,  $\times 3$ .
  - 15. ,, ,, sculpture, much enlarged.

# PLATE III.

- 1-3. Natalina compacta Conn., type in British Museum.
- 4-6. Nata liparoxantha (M. & P.), Pietermaritzburg.
  - 7. Natalina cafra (Fér.), Durban.
- 8-10. ,, kraussi (Pfr.), type in Stuttgart Museum.

All figures natural size.

#### PLATE IV.

FIG.

- 1-3. Natalina beyrichi (Mts.), Port St. John's.
- 4-5. Nata vernicosa (Krs.), Durban.
- 6-8. Natalina schaerfiae (Pfr.), Oudebosch.
- 9-11. ,, ,, var., Bredasdorp.

All figures natural size.

#### PLATE V.

- 1-3. Sheldonia lightfooti Conn., type in British Museum, ×2.
  - 4. ,, ,, apical sculpture, highly magnified.
- 5-6. ,, melvilli (G.-Aust.), Equeefa,  $\times 1$ .
- 7-9. ,, orientalis (G.-Aust.), East London, ×2.
- 10-11. ,, warreni Conn., type in Natal Museum,  $\times 1$ .
- 12-14. ,, puzeyi Conn., type in British Museum,  $\times 1$ .
- 15-17. Milax capensis (Krs.), shell, type in Stuttgart Museum,  $\times 3\frac{1}{3}$ .

## PLATE VI.

- 1-4. Afrodonta bimunita Conn., type in South African Museum, ×10.
- 5-7. Trachycystis glanvilleana (Ancey), type in British Museum, ×4.
- 8-10. , *lunaris* Conn., type in British Museum,  $\times 2$ .
- 11-13. ,, mediocris Conn., type in Albany Museum,  $\times 2\frac{2}{3}$ .
- 14-16. ,, viridula Conn., type in South African Museum,  $\times 2$ .
- 17-19. , falconi Conn., type in British Museum, ×6.
- 20–22. ,, rubra Conn., type in South African Museum,  $\times 2$  (the size line on plate is too short).

#### PLATE VII.

- 1-3. Trachycystis uitenhagensis (Krs.), type in Stuttgart Museum,  $\times 2\frac{1}{3}$ .
  - 4. ,, namaquensis (Mts.), topotype,  $\times 2$ .
  - 5. ,, africae (Brown), paratype in Acad. Nat. Sci., Philadelphia, ×2.
- 6-8. , aprica (Krs.), paratype in British Museum,  $\times 3\frac{1}{3}$ .
- 9. , conica Conn., type in Stuttgart Museum,  $\times 3$ .
- 10. ,, lovéni (Krs.), Durban, ×2.
- 11. ,, watsoni Conn., type in British Museum, ×2.
- 12-14. ,, microscopica (Krs.), type in Stockholm Museum,  $\times$  12.
  - 15. Afropunctum quadrisculptum Conn., type in British Museum,  $\times 6$ .
  - 16. ,, upper sculpture, highly magnified.
  - 17. ,, basal sculpture, highly magnified.
- 18-20. Sculptaria carinifera Conn., type in Berlin Museum, ×4.

FIG

#### PLATE VIII.

1-4.	Sculptaria edlingeri Conn., type in Berlin Museum, $\times 3\frac{1}{3}$ .	
5	Currella qualunta Conn type in British Museum V4	

- 6-8. Trigonephrus lucanus (Müll.), var. nana Conn., type in British Museum, ×1.
- 9-11. Dorcasia alexandri Gray, var. reflexilabris Conn., type in Berlin Museum. × 1.
  - 12. Cecilioides acicula (Müll.), Kimberley, ×6.
  - 13. , pergracilis Conn., type in British Museum,  $\times 6$ .
  - 14. ,, gokweanus (Bttg.), Pienaarspoort, ×5.
- 15-17. ,, ,, type, after Boettger,  $\times 4$ .

# PLATE IX.

- 1-2. Trachycystis mcdowelli Conn., type in British Museum, ×8 approximately.
- 3-4. ,, vengoensis Conn., type in British Museum, ×8 approximately.
- 5-6. ,, soror Conn., type in British Museum, ×8 approximately.
- 7-8. ,, pura Conn., type in British Museum, ×8 approximately.
- 9-10. Punctum pallidum Conn., type in British Museum, ×8 approximately.
- 11-12. Trachycystis rivularis (Krs.), type in Stockholm Museum, ×23.
- 13–14. ,, ,, var. densestriata Conn., type in British Museum,  $\times 2^{\frac{3}{2}}.$
- 15-17. ,, barnardi Conn., type in South African Museum, ×1.
  - 18. Trigonephrus haughtoni Conn., type in British Museum, ×1.
  - \*19. Xerocerastus hottentotus (Gray), type in British Museum, ×2.
  - 20. ,, ,, another specimen,  $\times 2$ .
  - \*21. ,, ovulum Conn., type in Albany Museum, Grahamstown, ×2.
    - 22. ,, ,, another specimen,  $\times 2$ .
  - \*23. ,, hottentotus (Gray) (type of pygmaeus H. Ad.), in British Museum,  $\times 2$ .
  - 24. ,, ,, another specimen of pygmaeus,  $\times 2$ .
- 25, 29. Prestonella bowkeri (Sow.), Somerset East, two specimens, ×1.
- 26-28. Sheldonia cornea (Pfr.), type in Stettin Museum, ×1.
- 30-31. Trachycystis gilliana Conn., type in South African Museum, ×1.
- 32-33. Zingis morrumbalensis (M. & P.), Macequece, ×1.

Note.—The unique type of T. gilliana is in somewhat weathered condition, so that the photograph gives it an appearance of coloration which it does not actually possess. It agrees in reality with T. barnardi in being uniform corneous brown.

#### PLATE X.

1. Achatina schinziana Mouss., Ngamiland.

FIG.

- 2. , zuluensis Conn., type in British Museum.
- 3. " ustulata Lam., Keurbooms R. bush.
- 4. .. vestita Pfr., Port St. John's.
- 5. ,, another specimen.
- 6. ,, ,, juvenis, highly magnified.

All figures, except No. 6, natural size.

\* Will be treated in Supplement.

#### PLATE XI.

FIG.

- 1. Achatina passargei Mts., paratype in Berlin Museum.
- 2. ,, transvaalensis Smith, type in British Museum.
- 3. ,, natalensis Pfr., type in British Museum.
- 4. , penestes M. & P., topotype in British Museum.
- 5. ,, churchilliana M. & P., type in Manchester Museum.
- 6. ,, dammarensis Pfr., Damaraland, slightly immature.
- 7. ,, subcylindrica Prest., "South Africa," in British Museum.
- 8. ,, tracheia Conn., paratype in British Museum.

All figures natural size.

#### PLATE XII.

- 1. Austrobalea africana (M. & P.), Karkloof, ×4.
- 2. Microstele noltei (Bttg.), Klip,  $\times 8$ .
- 3. Fauxulus ovularis (Küst.), var. fortidentata Conn., aperture,  $\,\times\,10^{2}_{3}.$
- 4. ,, pottebergensis (Küst.), in British Museum,  $\times 3\frac{1}{3}$ .
- 5. , barnardi Conn., type in South African Museum, ×6.
- 6. ,, ponsonbyanus (Morel.), Keurbooms R. bush, ×8.
- 7. ,, capensis (Küst.), yellow-banded variety, Buffelsfontein,  $\times 3\frac{1}{3}$ .
- 8. ,, ovularis (Küst.), Bredasdorp,  $\times 3\frac{1}{3}$ .
- 9. ,, pereximius (M. & P.), Port St. John's, ×5.
- 10. ,, pychnochilus Conn., type in Albany Museum, ×4.
- 11. ,, fryanus (Bs.), Bredasdorp,  $\times 3$ .
- 12. Lauria longa Conn., type in South African Museum, ×8.
- 13. Pupilla fontana (Krs.), Port Elizabeth, ×6.
- 14. Vertigo antivertigo (Drap.), Tlapingslaagte Well, ×10.
- 15. Nesopupa farquhari Pilsb., original, ×16.
- 16. Gastrocopta duplicata (Prest.), Pietersburg District, ×8.

# PLATE XIII.

- 1. Rachis punctata (Anton), Solapur, India.
- 2. ,, jejuna (M. & P.), Lebombo Mts.
- 3-5. Rachidina usagarica (Smith), Mtisherra R. Valley.
  - 6. , mozambicensis (Pfr.), Mozambique.
  - 7. ,, dubiosa (Stur.), Dondo District.
  - 8. ,, melanacme (Pfr.), paratype in British Museum.
  - 9. Edouardia tumida (Gibb.), Mtisherra R. Valley.
- 10. ,, sordidula (Mts.), Wanetsi River.
- 11. ,, transvaalensis (M. & P.), Makulane.
- 12. Rhachidina spilogramma (Mts.), Mtisherra R. Valley.
- 13. Edouardia meridionalis (Pfr.), Port Elizabeth.
- Rhachidina chiradzuluensis (Smith), Shiluwane District.
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FIG		
15.	Rachis pete	ersi (Pfr.), type in British Museum.
16.	Edouardia	metuloides (Smith), Mtisherra R. Valley.
17.	,,	junodi Conn., type in Kimberley Museum.
18.	,,	dimera (M. & P.), Karkloof.
19.	Rhachistia	sticta (Mts.), Mtisherra R. Valley.
20.	Edouardia	zuluensis (M. & P.), type in British Museum.
21.	,,	burnupi (M. & P.), type in British Museum.
22.	,,	conulus (Rve.), type in British Museum.
23.	,,	kaokoensis Conn., paratype in British Museum.
24.	,,	caffra (Pfr.), type in Stuttgart Museum.
25.	,,	,, ,, paratype in Stuttgart Museum.
26.	,,	arenicola (Bs.), var., Port Shepstone.
27.	,,	carinifera (M. & P.), Gordon Falls.
28.	,,	natalensis (Pfr.), Durban.
29.	,,	spadicea (Pfr.), Cape Natal.
30.	,,	mcbeaniana (Bnp.), Pretoria District.
31.	,,	,, lemaneensis Conn., type in British Museum.

All figures natural size.

cockerelli (Pilsb.), type in Academy of Natural Sciences, Philadelphia.

maritzburgensis (M. & P.), Thornybush.

#### PLATE XIV.

1. Limax maximus Lin. (after Ellis).

32.

33.

- 2. Testacella maugei Fér. (after Nobre).
- 3. Milax ponsonbyi (Clige.), after Collinge.
- 4. Apera sexangula Watson (natalensis Clige.), after Collinge.
- 5. Arion hortensis Fér. (after Ellis).
- 6. Onchidella pulchella Watson (after Watson), ×4 approximately.
- 7. Agriolimax agreatis (Lin.), after Nobre.
- 8. Oopelta nigropunctata Mörch. (after Collinge).
- 9. Onchidium verruculatum Cuvier (savignyi Récl.), after Semper.

All figures, except No. 6, are about natural size.

# PLATE XV.

J	Succinea	africana Bgt., type in Stuttgart Museum, ×2.
2.	,,	,, paratype in Stockholm Museum, ×1.
3.	,,	striata Krs., type in Stuttgart Museum, ×2.
4.	,,	,, ,, Pietermaritzburg, ×1.
5.	,,	connollyi Prest., paratype in British Museum, ×1.
6.	,,	exarata Krs., type in Stuttgart Museum, ×2
7.	,,	" ,, paratype in Stuttgart Museum, ×2.
8.	,,	delalandei Pfr., Maitland, ×1.
9.	,,	,, var. $kurri$ Mts., type in Berlin Museum, $\times 1$ .
10.	,,	badia Morel., Kaoko Otavi, ×1.